

**City of Coachella
General Plan 2020**

Draft Environmental Impact Report

State Clearinghouse #96071011, March, 1997



Prepared by: Smith, Peroni & Fox, Planning Consultants, Inc.

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City of Coachella
General Plan 2020
Environmental Impact Report

State Clearinghouse #96071011

DRAFT
March, 1997

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1.0 Executive Summary

1.0 EXECUTIVE SUMMARY

1.1 Executive Summary

Land Use Impacts and Mitigation Provided by Plan Policy

Buildout of the proposed General Plan will increase the number of dwelling units by approximately 45,150 over existing conditions. The amount of non-residential building area would increase by approximately 59,623,400 square feet. Major areas of growth associated with the project include Light Industrial (approximately 4,438 acres) and Entertainment Commercial (approximately 3,485 acres). There is also a substantial amount of land proposed for various residential densities (about 14,700 acres). Other significant land use categories include agriculture (about 14,563 acres), and Open Space-Conservation (about 7,090 acres). The General Plan Land Use Policy Diagram establishes the land use pattern throughout the planning area and is intended to promote orderly patterns of development. Policies in the Land Use Element serve to prevent land use conflicts from occurring both within the Planning Area and with uses in surrounding jurisdictions. Policies contained in other elements of the General Plan also serve to prevent land use impacts.

Unmitigable Impacts

The General Plan land use diagram and plan policies are anticipated to provide adequate mitigation to potential land use impacts and no further mitigation measures are required. Only the loss of agricultural land is considered a significant unmitigable impact.

Geotechnical Impacts and Mitigation Provided by Plan Policy

Those portions of the Planning Area with slopes steeper than 15 percent are subject to erosion of both soil and rock. Out of approximately 13,000 acres in the Mecca Hills area, about 3 percent contains slopes of 25 percent or more and about 8 percent contains slopes between 15 and 25 percent. Other potential geologic and geotechnical hazards which may limit development opportunities include: Slope instability, such as natural and man-made landslides, rockfall, mud/debris flow and soil creep; subsidence (groundwater withdrawal); expansive soils; compressible/collapsible soils, such as water induced ground collapse; percolation potential/effluent disposal; and, blasting impacts.

Several seismically active and potentially active faults occur in the northeastern portion of the Planning Area and in the vicinity. Active faults include the San Andreas, Painted Canyon, and Indio Hills faults. Active/potentially active faults within the planning area include portions of the Coachella Fan fault zone, Indio Hills fault, Painted Canyon and Skeleton Canyon fault zones. The General Plan includes policies requiring identification and avoidance of geotechnical hazards where possible and/or the use of construction techniques which recognize and accommodate geotechnical concerns. Individual projects are required to assess geotechnical hazards and mitigations on a site specific basis.

Unmitigable Impacts

General Plan Policies are anticipated to provide adequate mitigation, and no further mitigation is necessary. No significant unmitigable impacts related to geotechnical concerns are anticipated as a result of General Plan implementation.

Hydrology Impacts and Mitigation Provided by Plan Policy

Most of the incorporated City of Coachella is in Zone C, "Areas of Minimal Flooding" on the Flood Insurance Rate Map (FIRM) prepared by FEMA. The Coachella Storm Channel has been designed with sufficient capacity to protect the entire study area from the 100 year flood. However, remnants of 100-year flood zones are still shown on the FIRM. General Plan policy requires the City to coordinate with CVWD and FEMA to have these

areas removed and/or reclassified. Other potential impacts include an increase in impervious surfaces and resulting increased runoff; increased contribution of drainage to the agricultural tile drains which could reduce deficiency and contribute to a rising water table; and the potential for degrading surface water quality due to urban pollutants from street runoff. Guiding and Implementing Policies in the General Plan are designed to mitigate these potential impacts by requiring design review for individual projects related to flooding, agricultural drainage and surface water quality.

Unmitigable Impacts

Policies in the General Plan will adequately mitigate any impacts associated with drainage issues, water quality and flooding. No significant unmitigable adverse impacts are anticipated with respect to these issues.

Biotic Resources Impacts and Mitigation Provided by Plan Policy

Implementation of the proposed General Plan will reduce the amount of habitat available to wildlife due to conversion of undisturbed (native vegetation) and agricultural land to urban uses. Within the valley floor, native vegetation is fragmented and considered of low habitat value. Undisturbed land in the Mecca Hills is considered of higher value. Specific sensitive biological resources recorded in the Planning Area include the Black-tailed gnatcatcher, Burrowing owl, Coachella Valley fringe-toed lizard, Crissal thrasher, Ferruginous hawk, Golden eagle, Loggerhead shrike, Northern harrier, Palm Springs ground squirrel, Spotted bat, and the Vermilion flycatcher. Of all these species, only the Coachella Valley fringe-toed lizard is officially listed as a federally threatened and State endangered animal which requires mitigation by law if habitat would be disturbed. However, General Plan policies require that any substantial conversion of agricultural or vacant lands be evaluated for biological habitat prior to their conversion to urban uses. Other policies provide for maintenance and perpetuation of wildlife refuges and preserves, encouraging contribution to Multi-species Habitat Conservation Plans and Habitat Management Plans, and designation of large publicly owned portions of the Mecca Hills as open space.

Unmitigable Impacts

Despite the General Plan's emphasis on conservation of biotic resources, the net loss of habitat due to implementation of the General Plan will contribute on a cumulative level to the regional loss of habitat that has been taking place since urbanization of the Coachella Valley and southern California first began. These effects are deemed to be a significant unmitigable adverse impact unless all development is discontinued, which is not considered a viable option.

Circulation Impacts and Mitigation Provided by Plan Policy

The City has determined that the minimum acceptable level of service will be LOS D at buildout of the General Plan and has evaluated the proposed circulation system in light of General Plan land use. Although all roadways are projected to operate at acceptable levels of service, the alignment of the existing road system tends to focus traffic along two corridors. The major traffic corridor with the greatest volume on arterial streets is north along Harrison Street to Grapefruit Boulevard, to Dillon Road, to the SR 86 Freeway. The secondary corridor is north along Tyler Street, to Grapefruit Boulevard, to Avenue 52, to the SR 86 Freeway. The majority of LOS D roadway links occur along these two corridors. The General Plan Circulation Element designates a future circulation system which achieves LOS D or better for all major roadways within the City and is supported by policies designed to implement and fund the roadway system and monitor traffic volumes for appropriate timing of facility construction. In addition, the Circulation Element contains policies for the orderly development of rail, airport, public transportation, nonmotorized transportation (bicycle, equestrian, pedestrian) and the designation of truck routes.

Unmitigable Impacts

Policies in the General Plan will adequately mitigate all impacts associated with circulation/traffic issues. No significant unavoidable adverse impacts are anticipated to result from General Plan implementation.

Air Quality Impacts and Mitigation Provided by Plan Policy

Implementation of the General Plan would result in generation of additional pollutants from stationary sources (construction activities, electrical and natural gas usage) and mobile sources primarily from increased vehicular travel. Short-term impacts will result from construction activities due to site disturbance and emissions from construction equipment.

Numerous specific policies contained in the General Plan are designed to achieve healthful air quality. Development is encouraged to be designed in a manner that will minimize direct and indirect emissions of air contaminants. There are also policies which require adoption of procedures and regulations which minimize particulate emissions during construction activities. Measures which promote energy conservation to minimize stationary source emissions are also included. By incorporating AQMP measures and policies in the General Plan, the City will show a commitment to improving air quality through its community planning and development process on a local level.

Unmitigable Impacts

Although the City of Coachella will incorporate air quality measures established by the South Coast Air Quality Management District in the General Plan to mitigate impacts on a local level, continued exceedance of state and federal air quality standards will occur on a regional level.

Noise Impacts and Mitigation Provided by Plan Policy

Noise sources related to project implementation will include general vehicle traffic, the Southern Pacific Railroad, the Thermal Airport, and short term construction noise.

Implementation of the General Plan will generate 1,408,720 daily vehicle trips, thus increasing traffic noise in the area. Trains passing through the City will also cause noise impacts and new residential developments adjacent to the railroad will be required to mitigate these impacts. Additional impacts may be associated with the Thermal Airport due to overflights as a result of airport operations. Although noise impacts caused by construction will occur throughout General Plan buildout, they are anticipated to be short term and can be mitigated as discussed below.

Numerous specific policies contained in the General Plan are designed to reduce noise by promoting noise abatement measures including installing sound walls, insulation, berms, and landscaping. Development is encouraged to be designed in a manner that will minimize direct and indirect noise impacts. Impacts caused by the Thermal Airport are mitigated by the airport's Master Plan which identifies existing and future noise contours and General Plan policy which requires disclosure of areas subject to excessive aircraft noise volumes.

Unmitigable Impacts

General Plan implementation is anticipated to result in a general increase in ambient noise levels within the City greater than 3.0 decibels and in potential exposure of existing residential areas to noise levels greater than 65 CNEL. These are considered to be unmitigable significant adverse impacts of plan implementation.

Visual Resources Impacts and Mitigation Provided by Plan Policy

The primary visual impact of General Plan implementation will be a probable increase in urban growth. It would permanently alter some portions of the Planning Area from agriculture or open space to urban development. Such growth could be perceived by some as a negative aesthetic impact in comparison with the current condition dominated by agriculture. In response to this impact, the General Plan has policies under the Urban Design Element which ensure that new development conforms to architectural standards which will both enhance the visual quality of the City and mitigate any potential adverse impacts of urban growth. In addition, the General Plan designates approximately 14,500 acres for continued agricultural production which is about 27 percent of the overall Planning Area and 61 percent of existing agricultural lands. Other policies address the design of a streetscape, image corridors, and City gateways as well as discouraging vandalism and graffiti. The effects of light and glare are also addressed by policies requiring attention to lighting design. These policies will mitigate visual impacts to a level of insignificance.

Unmitigable Impacts

Impacts are mitigated by General Plan policy and no unmitigable impacts are anticipated.

Historical/Archaeologic/Paleontologic Resources Impacts and Mitigation Provided by Plan Policy

Approval of the General Plan will encourage development within the Planning Area which could potentially have an adverse impact on historic, archaeological and paleontologic resources. Archaeological resources have a high probability for occurrence in the study area. Policies in the General Plan serve to identify, maintain, and protect historic, archaeological, and paleontologic resources. Historic/archaeological resources that are identified during a records search or field survey must be evaluated for significance and mitigated if found to be significant. The Planning Area has been mapped according to previously identified resources and potential for occurrence of cultural resources. General Plan policies deal with each of these areas which will ensure proper identification and mitigation of paleontologic resources.

Unmitigable Impacts

General Plan policies are anticipated to provide adequate mitigation and no further measures are necessary. There are not expected to be any unmitigable impacts associated with archaeological and paleontologic resources as a result of General Plan implementation.

Water Impacts and Mitigation Provided by Plan Policy

Potential growth associated with implementation of the General Plan would result in increased water consumption of up to 57 million gallons per day for urban uses. However, this is largely offset by the fact that over 7,000 acres of the more water intensive agricultural lands will be converted to urban use, resulting in a net increase in water consumption of about 12 million gallons per day as compared with existing water consumption. To accommodate this increase, the General Plan contains water management policies which ensure a reliable supply of water for agricultural and urban uses. Water supply, storage and distribution facilities are either available or planned by the City or CVWD to serve the Planning Area except the Mecca Hills area. To ensure water supplies in the Mecca Hills, General Plan policy encourages continuation of existing procedures of reviewing each development project for water supply issues.

Unmitigable Impacts

Although implementation will reduce the amount of water intensive agricultural land through urbanization, the project will result in a net increase in water consumption of 12 MGD. Since groundwater aquifers are considered to be in a state of overdraft, this increase is considered a significant unavoidable adverse impact.

Wastewater Impacts and Mitigation Provided by Plan Policy

Potential growth associated with implementation of the General Plan would result in an estimated increase in wastewater generation of 34.6 million gallons per day (MGD) for a total of 38.0 MGD at buildout. This is under the 61.1 MGD design capacity of the wastewater treatment plants that serve the Planning Area. General Plan policies require the City to coordinate with sanitary sewer service providers to ensure that adequate facilities are in place to meet increased wastewater demands. Individual septic disposal systems are discouraged by General Plan policy due to the shallow perched water condition in the Planning Area. Both of the major sanitary sewer service providers are in the process of completing Sewer Master Plans so that long range facilities planning and funding strategies will be in place.

Unmitigable Impacts

General Plan policies are anticipated to provide adequate mitigation and no further measures are necessary. There are not expected to be any unmitigable impacts associated with wastewater collection and treatment as a result of General Plan implementation.

Solid Waste Impacts and Mitigation Provided by Plan Policy

Potential growth associated with implementation of the General Plan would result in an estimated increase in solid waste generation of 144 tons per year. The local solid waste collection service (Western Waste Industries) has indicated that they can adequately serve the future needs of the Planning Area. However, General Plan policies will serve to reduce the amount of solid waste taken to landfills by encouraging recycling and other waste reduction measures.

Unmitigable Impacts

General Plan policies are anticipated to provide adequate mitigation and no further measures are necessary. There are not expected to be any unmitigable impacts associated with solid waste collection as a result of General Plan implementation.

Energy, Telephone and Cable TV Impacts and Mitigation Provided by Plan Policy

Buildout under the proposed General Plan update will result in a substantial increase in the consumption of electricity and natural gas in residential, commercial and industrial buildings. The Gas Co. representatives have indicated that natural gas can be provided to the City from existing facilities in the area, although extension of lines will be required in some areas. The Imperial Irrigation District has indicated that ultimate buildout of the General Plan would have a significant impact on their existing facilities. However, the District has stated that with planned improvements, and as long as growth occurs in an orderly fashion, the proposed development can be accommodated. In addition, a number of energy conservation policies have been incorporated into the General Plan. Growth associated with General Plan implementation will also add to the demand for telephone and cable television services. GTE has indicated that they can provide services on a project by project basis as demand increases. For areas 1,000 feet or greater from existing facilities and certain commercial projects, GTE requires payment of fees to cover the cost of line extensions. Continental Cablevision has plans to upgrade its system and is required to provide service to areas with a minimum of 40 dwelling units per cable route mile. Existing protocols as well as General Plan policies are anticipated to address issues relating to the provision of adequate utility services.

Unmitigable Impacts

General Plan policies and existing protocols are anticipated to provide adequate mitigation and no further measures are necessary. There are not expected to be any unmitigable impacts associated with provision of telephone and cable television services as a result of General Plan implementation. Despite the incorporation of all feasible energy saving policies, however, project implementation will result in a substantial increase in the use of non-renewable energy resources which would be considered a significant unavoidable adverse impact.

Law Enforcement Impacts and Mitigation Provided by Plan Policy

Implementation of the proposed General Plan will create additional demands on law enforcement services due to potential increases in new commercial, industrial and residential use. It is anticipated that future development resulting in higher assessed property valuation will adequately support future police department funding. However, development will be evaluated on a project specific basis and it may be necessary to impose development impact fees on new construction at some point. In addition, the General Plan incorporates numerous policies to ensure the provision of adequate law enforcement services.

Unmitigable Impacts

No unmitigable significant adverse impacts related to the provision of law enforcement services are anticipated as a result of General Plan Implementation.

Fire and Paramedic Services Impacts and Mitigation Provided by Plan Policy

Implementation of the proposed General Plan will create additional demands on fire and paramedic services due to potential increases in new commercial, industrial and residential uses. To address this issue, the General Plan contains policies which will ensure that these services are provided. Other policies are designed to reduce the risk of potential fire hazards.

Unmitigable Impacts

No unmitigable significant adverse impacts related to the provision of fire and paramedic services are anticipated as a result of General Plan Implementation.

Parks and Recreation Impacts and Mitigation Provided by Plan Policy

Implementation of the proposed General Plan has the potential to increase the population in the Planning Area and will therefore create additional demands on parks and recreational facilities. The land use plan sets aside over 7,000 acres as "Open Space-Conservation" which could potentially be used for recreational activities. The land use plan also incorporates several approved specific plans which contain recreational elements. In addition, General Plan policies are designed to set park standards and ensure the development of new parks as population increases.

Unmitigable Impacts

The General Plan policies and land use diagram will to provide adequate mitigation and no unmitigable significant adverse impacts related to the provision of parks and recreational services are anticipated.

Schools Impacts and Mitigation Provided by Plan Policy

Many schools which currently serve students residing in the Planning Area are already over capacity. Therefore, any additional growth would have a significant impact on area schools prior to mitigation. Policies in the General Plan which address this issue include collection of fees for new development to help fund new school facilities.

Unmitigable Impacts

Despite the policy mitigations contained in the General Plan, without adequate available funding sources there is still the potential that facilities and resources may not be available to serve the school needs of a growing population. Consequently, school impacts are considered a significant, unavoidable adverse impact.

Health Facilities Impacts and Mitigation Provided by Plan Policy

The potential population increase associated with General Plan implementation will result in additional demand at local health care facilities including JFK Hospital. However, with the proposed facility expansion and proposed Immediate Care Center hospital officials have indicated that they can adequately provide medical services to residents of the Planning Area in the future.

Unmitigable Impacts

No significant or unmitigable impacts to medical facilities are expected to occur as a result of General Plan implementation.

Library Facilities Impacts and Mitigation Provided by Plan Policy

Implementation of the General Plan has the potential to increase the City's population and will therefore create additional demands on the library system. The increase in residential housing within the Planning Area will provide additional revenue available from property taxes and create a larger population base for acquisition of State funds. General Plan Policies provide goals to achieve levels of service that meet or exceed minimum standards, including providing convenient and accessible facilities for all City residents. Therefore, impacts on the library system as a result of General Plan implementation are considered insignificant.

Unmitigable Impacts

No significant or unmitigable impacts to library facilities are expected to occur as a result of General Plan implementation.

Public Transportation Impacts and Mitigation Provided by Plan Policy

Implementation of the General Plan has the potential to increase the City's population which will create additional demands on the transit system. The added passengers created by the population increase associated with General Plan buildout will partially fund additional transit facilities and services through increased sales tax revenue and user fees. General Plan transit policies require the City to coordinate with SunLine Transit to attain a balance of transportation opportunities within the Planning Area and to identify potential park and ride facility locations. These policies will bring impacts related to General Plan implementation to a level of insignificance.

Unmitigable Impacts

No significant or unmitigable impacts to public transit facilities are expected to occur as a result of General Plan implementation.

1.2 Significant Adverse Impacts not Mitigated by the Draft General Plan

An objective of the General Plan is to implement well-designed policies which will avoid causing significant adverse environmental impacts. In this sense, the Plan is seen as "self-mitigating." Despite this goal, significant adverse environmental impacts remain, some attributable to implementation of the Plan, others as a result of regionally cumulative impacts. Each is described in more detail in the appropriate section of the Draft EIR:

- ▶ **Agricultural Land:** Implementation of the General Plan will result in a loss of approximately 9,271 acres (39%) of agricultural land when compared with existing land uses in the project area. When compared with the existing General Plan, the amount of agricultural land converted to more intense urban uses drops to approximately 6,698 acres.
- ▶ **Biotic Resources** (regional and cumulative impact issue): Although the City of Coachella will incorporate mitigation measures to conserve biotic resources on a local level, Coachella's incremental contribution to disturbance of habitat on a cumulative/regional level is considered significant.
- ▶ **Air Quality** (regional and cumulative impact issue): Although the City of Coachella will incorporate air quality measures established by the South Coast Air Quality Management District in the General Plan to mitigate impacts on a local level, continued exceedance of state and federal air quality standards will occur on a regional level.
- ▶ **Water Supply** (regional and cumulative impact issue): Although implementation will reduce the amount of water intensive agricultural land through urbanization, the project will result in a net increase in water consumption of 12 MGD. Since groundwater aquifers are considered to be in a state of overdraft, this increase is considered a significant unavoidable adverse impact.
- ▶ **Schools:** Despite the policy mitigations contained in the General Plan, without adequate available funding sources there is still the potential that facilities and resources may not be available to serve the school needs of a growing population. Consequently, school impacts are considered a significant, unavoidable adverse impact.
- ▶ **Noise:** General Plan implementation is anticipated to result in a general increase in ambient noise levels within the City greater than 3.0 decibels and in potential exposure of existing residential areas to noise levels greater than 65 CNEL. These are considered to be unmitigable significant adverse impacts of plan implementation.

1.3 Impacts Found not to be Significant at a Local Level

With full General Plan implementation, some of the proposed measures are anticipated to have environmental impacts which are either found not to be significant at a local level, or are expected to have a net positive impact on the City's resources. This is true of the following:

- ▶ Geotechnical, Soils and Seismicity
- ▶ Surface Hydrology
- ▶ Biotic Resources
- ▶ Traffic and Circulation
- ▶ Visual and Aesthetic Resources
- ▶ Historic, Archaeologic, and Paleontologic Resources
- ▶ Public Utilities
 - ▶ Water (except for water supply)
 - ▶ Wastewater
 - ▶ Solid Waste
 - ▶ Natural Gas
 - ▶ Electricity
 - ▶ Telephone and Cable
- ▶ Public Services
 - ▶ Law Enforcement
 - ▶ Fire and Paramedic Services
 - ▶ Parks and Recreation
 - ▶ Health Facilities

- ▶ Library Facilities
- ▶ Public Transportation
- ▶ Mineral Resources

1.4 Summary of Alternatives

Five alternatives to the Draft General Plan were evaluated and are described in Section 5.

The Proposed Project (Proposed General Plan)

Development under the proposed project would result in approximately 50,497 residential units, and approximately 61,361,700 square feet of non-residential land uses. The projected buildout population under the proposed project is approximately 153,511 persons.

Alternative 1: No Project (Existing General Plans)

This alternative assumes buildout of the Coachella Planning Area under the existing City of Coachella General Plan, as adopted. It also assumes buildout under the Riverside County General Plan for all unincorporated portions of the Planning Area. Development under this alternative would result in a approximately 29,608 residential units, and approximately 75,009,500 square feet of non-residential uses within the project area at buildout. The projected buildout population under the existing General Plan is approximately 90,008 persons.

Alternative 2: Agricultural Preservation - No Entertainment Zone

This alternative would result in the preservation of nearly all agricultural areas within the study area but would reduce the amount of low density residential land and eliminate entirely the proposed Entertainment Area. In comparison with the project, dwelling units and population would be reduced by about 22%, while the non-residential building square footage would be lowered by about 5%.

Alternative 3: Mecca Hills Preservation

Assumes preservation of the Mecca Hills by designating all RVL lands east of the All-American Canal under the Riverside County General Plan designation of Desert Areas which allows one dwelling unit per ten acres. This would result in approximately 584 dwelling units as compared with a potential of over 8,000 units under the proposed General Plan. When combined with the Bureau of Land Management lands, this alternative would preserve a substantial portion of the Mecca Hills as open space with the exception of the McNaughton Specific Plan.

Alternative 4: Reduced Traffic (25% Reduction of Industrial Land Uses)

This alternative would result in about 3,396 acres of industrial uses, reducing industrial square footage by about eleven million square feet compared to the proposed project. It is assumed that the acreage removed from Industrial use would remain in agricultural production, which would allowing an additional 28 dwelling units (at 1 du/40 acres). Since the large amount of industrial land is a significant contributor to future traffic volumes within the city, this would reduce traffic west of the Coachella Valley Stormwater Channel where traffic impacts are greatest. This alternative would also reduce other traffic-generated impacts such as noise along roadways and vehicle emissions.

Alternative 5: Kohl Ranch

This alternative assumes that the Kohl Ranch Specific Plan project located south of the Thermal Airport is approved by Riverside County. The Specific Plan encompasses 2,177 acres, of which about 1,280 acres are in the Coachella Planning Area. The project would add approximately 2,200 dwelling units and 6.4 million square feet of non-residential uses within the Planning Area.

2.0 INTRODUCTION

2.1 Purpose and Scope

This Environmental Impact Report (EIR) has been prepared in accordance with the California Environmental Quality Act (CEQA) Guidelines. It has been prepared to assess impacts associated with the City of Coachella General Plan Update. It analyzes the effects of the goals, policies, and programs, as well as the environmental impacts associated with the proposed land use and circulation patterns. The General Plan is mandated by State law and requires each City and County to prepare a long-range, comprehensive plan for the physical development of the jurisdiction and any land outside its boundaries which the agency deems relevant for planning purpose.¹ The General Plan is also intended as the document which will ensure adequate services and infrastructure, preserve and protect the environment, manage natural resources and provide economic programs and assistance.

The purpose of this document is to provide the lead agency (City of Coachella), other responsible or interested agencies and the public with information to be used in evaluating the environmental issues and potential impacts associated with adoption and implementation of the proposed General Plan.

The scope of the EIR was determined by City Planning staff through completion of an Initial Study which is part of the Notice of Preparation (NOP) for the General Plan Environmental Impact Report. This is included as Appendix A in the Technical Appendix attached under separate cover.

2.2 Authorization

The authorization for the City of Coachella to require an EIR to evaluate the impacts of the General Plan Update derives from CEQA which states that "all local agencies shall prepare, or cause to be prepared by contract, and certify the completion of an Environmental Impact Report on any project they intend to carry out and approve which may have a significant effect on the environment" (CEQA Section 21151). The City determined that this project may have a significant effect on the environment and therefore required preparation of this EIR. However, CEQA Guidelines Section 15146 states that an EIR for a project such as a General Plan update "should focus on the secondary effects that can be expected to follow from the adoption or amendment, but the EIR need not be as detailed as an EIR on the specific construction projects which might follow."

2.3 Required Actions and Uses of this EIR

The proposed actions subject to environmental review in this EIR include certification of the EIR, approval of the proposed General Plan Update and General Plan Land Use Maps, approval of updated zoning maps, and adoption of CEQA findings pursuant to the CEQA Guidelines Section 15091.

This EIR is intended to be used to allow "tiering" of the environmental review process for future public and private development under the General Plan such as tract maps, specific plans, and other development proposals. It is also intended as an informational base for subsequent zoning ordinance revision.

In addition, a number of state, federal, and regional agencies are expected to review and comment on the document. These agencies include the following:

- Coachella Valley Association of Governments
- Coachella Valley Water District
- South Coast Air Quality Management District
- Southern California Association of Governments
- California Department of Fish and Game

¹ State of California General Plan Guidelines, November 1990.

- California Department of Transportation
- California Regional Water Quality Control Board
- U.S. Fish and Wildlife Service

2.4 Project Setting

2.4.1 Location and Boundaries

The City of Coachella is located in the southwestern portion of the Coachella Valley in Riverside County, California. The General Plan is mandated by State law and requires each City and County to prepare a long-range, comprehensive plan for the physical development of the jurisdiction and any land outside its boundaries which the agency deems relevant for planning purposes. The Study Area for the General Plan update includes the incorporated City of Coachella, its Sphere of Influence, and other surrounding areas which could have an effect on the planning process in the City. The boundaries of the Planning Area were chosen by the City to assure that adequate data would be available for analyzing the future growth of the City of Coachella and its environs, and for the analysis of future services and infrastructure, circulation and traffic, compatibility of land uses in outlying areas and environmental concerns. The lands included with the Planning Area boundary were not limited to those included within the City of Coachella's Sphere of Influence. Lands included in the Planning Area were chosen because of their importance to Coachella's future. Most of the lands included within the Planning Area which are not within the City of Coachella's Sphere of Influence are not included in any jurisdiction's sphere. One area that is included within the Planning Area is within the City of La Quinta's Sphere of Influence and borders the City of La Quinta's current city limits, the City of Indio's current city limits, and Coachella's adopted Sphere of Influence. This area was included because of the expectation that future development will require comments from the City of Coachella. The availability of environmental and general planning data for the whole planning area assures the ability to respond to future issues with consistent information and an overall approach whether the City of Coachella is making the decision or responding to a decision to be made by another jurisdiction.

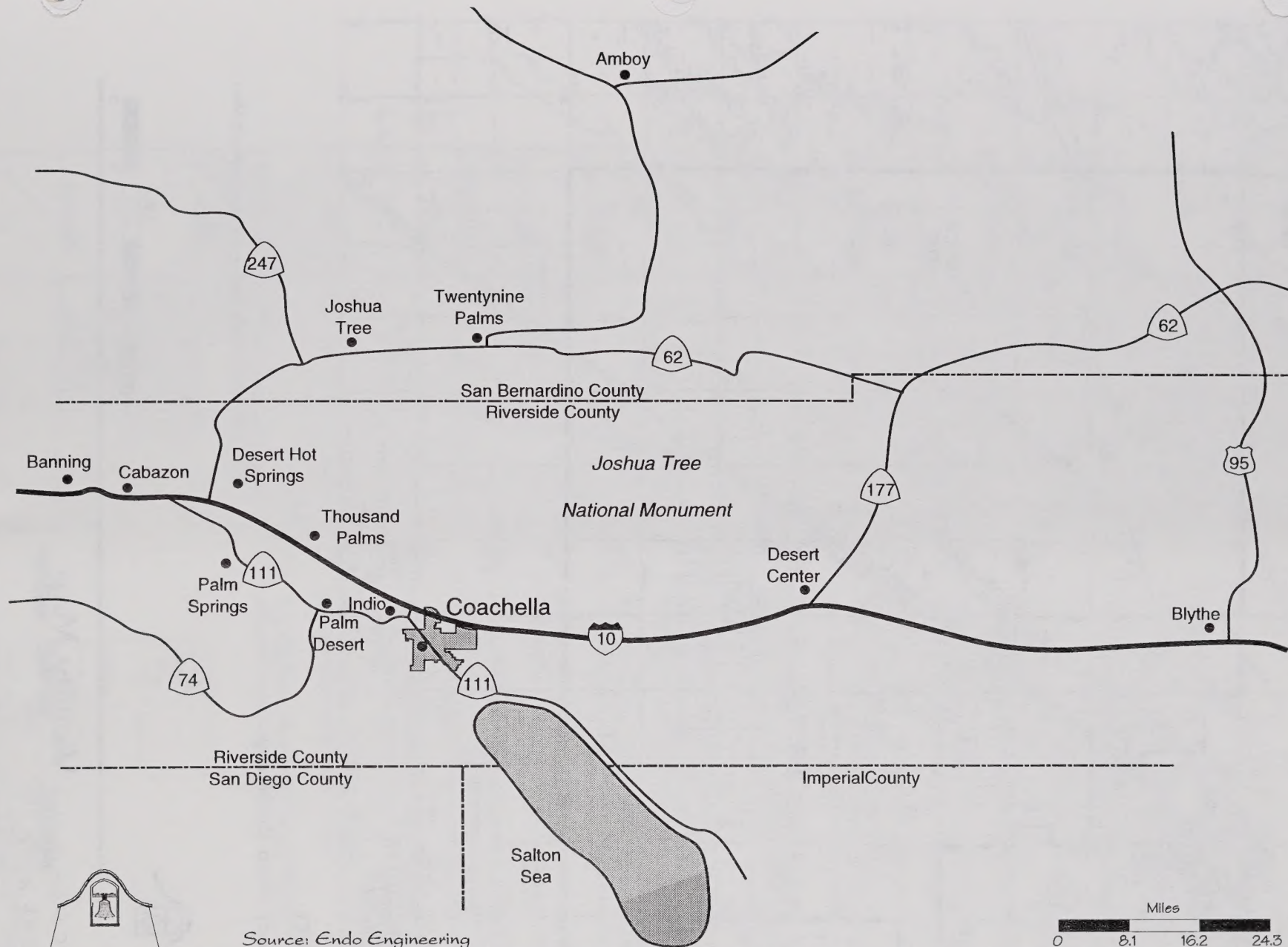
It is generally bounded by Monroe Street on the west, Avenue 62 on the south, Johnson Street on the east, and by Avenue 44 on the north. Figure 2.4-1, Regional Map shows the regional location of the City and Figure 2.4-2, Vicinity Map shows the Study Area boundary.

2.4.2 Physical Setting

The project area is in a portion of the Coachella Valley which ranges in elevation from 1,000 feet in the Mecca Hills to the east, to about 160 feet below sea level south of Thermal. However, most of the Study Area is relatively flat, sloping gently from northwest to southeast. Key geographic features in the area include the Santa Rosa Mountains to the west and south of the Study Area; the Mecca Hills; and the Indio Hills to the north beyond which is the Little San Bernardino Mountains in the distance. The project area is bisected by the Whitewater River, and the Coachella Canal, both of which traverse generally northwest to southeast. The character of the project area outside the urban core of the City itself, is dominated by a considerable amount of land in agricultural production.

2.4.3 Related Environmental Documents

In addition to the technical studies prepared for this EIR, various other environmental reports which occur in the vicinity of this project were consulted and incorporated as source documents. These are shown in Figure 2.4-3, Index to Environmental Documents.

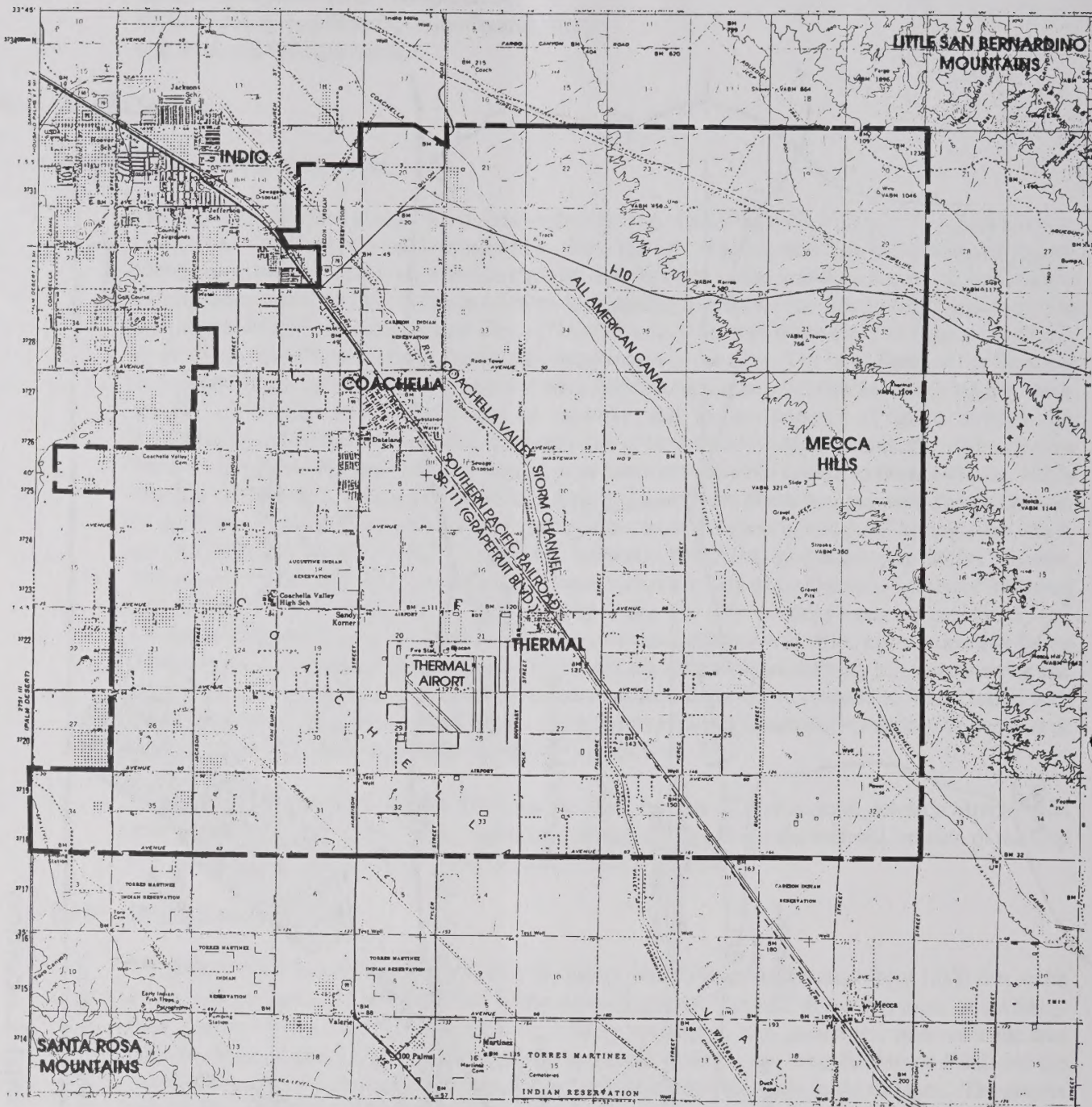


Source: Endo Engineering

Regional Location

Smithy, Peroni & Fox, Planning Consultants, Inc.
225 S. Civic Dr., Suite 1-5 Palm Springs, CA 92262

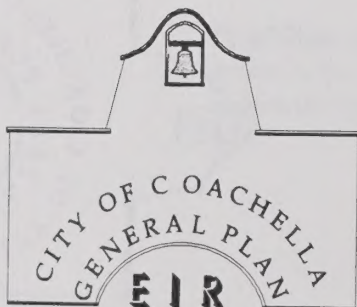
Figure No. 2.4-1



LEGEND

 Study Area Boundary

Source:
USGS Coachella, California Quadrangle (15 Min.)



Vicinity Map

Smith, Peroni & Fox, Planning Consultants, Inc.
225 S. Civic Dr. Suite 1-5 Palm Springs, CA 92262

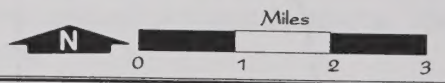


Figure No. 2.4-2



Index to Environmental Documents

- 1 McNaughton Specific Plan
Keith Companies Prepared for the City of Coachella, Feb. 1989.
- 2 Rancho Coachella Vineyards SP EJR
The Keith Companies, Prepared for Rancho Coachella Properties, Inc. Mar. 1988.
- 3 EA for the Indian Sands Community PUD, Cabazon Indian Reservation.
Lilburn Corp. Prepared for the U.S. Dept. of the Interior, Bureau of Indian Affairs, Cabazon Band of Mission Indians and Ocotillo Development Corp. Feb. 1993.
- 4 Proposed Development Thermal Airport, Riverside County, Ca. Final EJR/EA Vol. J & JJ.
Coffman Associates, Inc. for Riverside County, Ca., EDA, Aviation Unit, June 1991.
- 5 City of Coachella Brandenburg/Butters Coachella 380 SP and Draft EJR.
Smith, Peroni & Fox, Prepared for City of Coachella, May 1990.
- 6 Rancho La Quinta SP Final EJR #218.
WESTEC Services, Inc. Prepared for Riverside County, Ca. Sept. 1988.
- 7 State Route 86 in Riverside County EA
California Department of Transportation, Prepared for Caltrans, Dec. 1989.
- 8 Final EJR #189 Eastern Coachella Valley Community Plan and Comprehensive GPA #9-84.
Riverside County Planning Department, for Riverside County, Ca. Oct. 1994.
- 9 Coachella General Plan Update EJR.
Sanchez Talarico Associates, for City of Coachella, July 1986
- 10 Indio General Plan DEJR
Chambers Group, for City of Indio, Oct. 1993
- 11 La Quinta General Plan DEJR
BRW, for City of La Quinta, July 1992

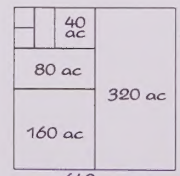
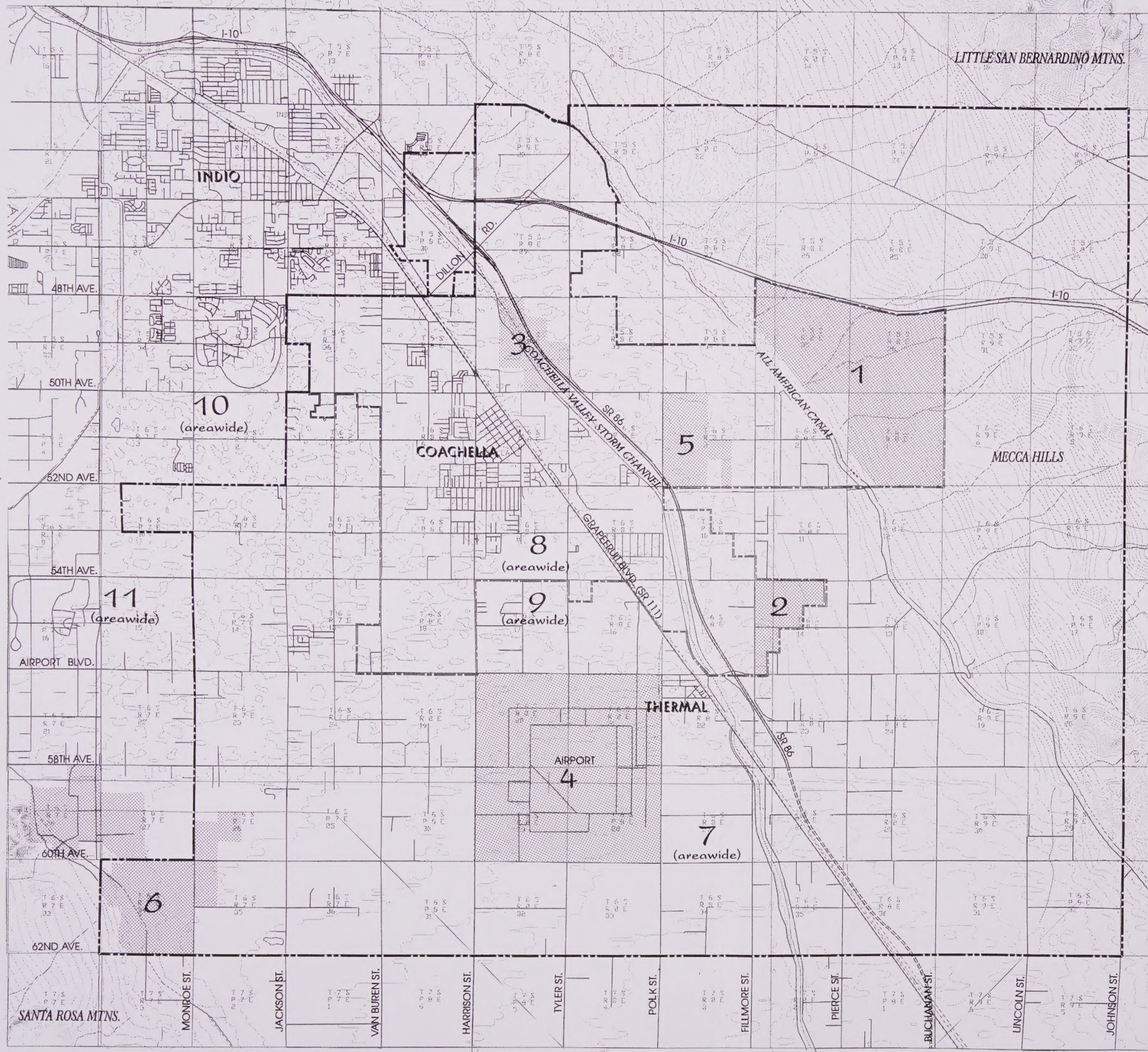


Figure No. 2.4-3





2.5 Project Description

The City's General Plan was last updated in 1987 and has become outdated due to changes in the community's vision of future growth and the desire to encompass a larger study area. The proposed project is a comprehensive update of the General Plan for the City of Coachella and the surrounding study area, as well as revision of the City's General Plan Land Use Diagram. State-mandated elements (with the exception of the Housing Element), as well as various optional elements have been revised. The revised General Plan elements which are evaluated in this EIR include the following:

- The Land Use Element of the General Plan designates the proposed general distribution, general location and extent of the uses of land. It also includes a statement of the standards of population density and building intensity. (State mandate)
- The Circulation Element of the General Plan is consistent with the Land Use Element and identifies the general location and extent of existing and proposed major thoroughfares, transportation routes, bikeways, pedestrian paths and equestrian trails. (State mandate)
- The Urban Design Element of the General Plan establishes policies appearance of the City. This element is intended to provide standards that, when implemented, will enhance the City's visual image. (Optional)
- The Infrastructure & Public Services Element of the General Plan identifies the City's policies relative to developing and maintaining an efficient and functional Citywide system of infrastructure and public services. Infrastructure includes water, wastewater, drainage, natural gas, electric and telephone facilities. Public services include law enforcement, fire protection, postal, public education, health care and municipal services. (Contains portions of State mandate Circulation Element)
- The Conservation Element of the General Plan provides for the conservation, development and utilization of natural resources including, topographic, geologic, archaeological, historic, biotic, ground water, surface water, energy and mineral resources. (State mandate)
- The Open Space and Parks Element of the General Plan identifies the City's policies for preserving open space for natural resources, the managed production of resources, outdoor recreation, public health and safety, and the provision of improved park and recreation facilities. (Open Space Element is State mandate)
- The Agriculture Element of the General Plan identifies the City's policies for managing the extensive agricultural lands occurring within the City. (Optional)
- The Environmental Hazards & Safety Element of the General Plan incorporates the required analysis to be contained in the Noise Element, and includes other hazards such as geologic and seismic, soils, flood, fire, noise and air quality. (Contains State mandated Noise and Safety Elements)
- The Fiscal Element of the General Plan is concerned with ensuring a fiscally sound city government capable of funding the projects necessary to protect the public health, safety and welfare, and with adequate resources for community enhancement. (Optional)

The General Plan for the City is a compilation of the goals, policies, and objectives that will guide physical development in the City, and in those areas which the City considers within its planning purview (i.e., existing spheres of influence and surrounding Study Area). The General Plan expresses community development goals for the distribution of future land use. The Plan has been revised concurrently with EIR preparation to incorporate measures which reduce environmental impacts. The proposed General Plan Land Use Map is included in this document as Figure 3.1-5. A complete description of existing and proposed land uses as well as impacts of this project is provided in Section 3.1.

The objectives of the General Plan update include the following:

- To adopt the updated City of Coachella General Plan and its Goals, Policies, and Objectives in each element in order to provide the City with guidelines for future development of the City and its Sphere of Influence.

- To update existing land uses and environmental conditions in the Planning Area in order to identify opportunities and constraints on future development.
- To ensure that General Plan elements are internally consistent and consistent with the City's Zoning Code and in conformance with all local, State, and Federal laws including State of California General Plan Law and the California Environmental Quality Act.

3.0 Environmental Impacts

3.0 ENVIRONMENTAL IMPACT ANALYSIS

3.1 Land Use

This section of the Environmental Impact Report is intended to provide a comparison of the designation and distribution of land use at buildout under the proposed General Plan Update with two other land use scenarios:

- 1) the existing physical condition: i.e., land uses as they exist in Coachella today (1996);
- 2) the existing regulatory condition: i.e., land uses as they would exist in Coachella assuming buildout under the current City and County General Plans

In addition, this chapter will discuss proposed General Plan policy as it relates to land use, will assess land use compatibility (both internally within the plan itself and externally with bordering jurisdictions), and will discuss conformity with regional plans. Proposed land use patterns and policy relating to each specific environmental issue (i.e., air quality, traffic, noise, etc.) are addressed in the applicable sections of this EIR.

Existing Land Use

A land use survey of the Planning Area was conducted by Smith, Peroni & Fox in March 1996, in order to provide a baseline from which to compare future land uses. Utilizing assessor's parcel maps and recent aerial photographs, land uses were recorded during the course of windshield surveys of the Planning Area. Once existing uses were established and mapped, the acreage of each parcel was categorized by land use type and land use acreage within the study area were then aggregated. For purposes of comparison and analysis, land uses are condensed into common categories applicable to all three land use scenarios (proposed General Plan, existing physical condition, existing regulatory condition). Table 3.1-1, Existing (1996) Physical Land Use Summary, presents the total acreage of existing land uses within the Planning Area while Figure 3.1-1, Existing Land Use, depicts the generalized location of land uses.

Table 3.1-1 Existing (1996) Physical Land Use Summary				
LAND USE	DWELLING UNITS	BUILDING AREA (sf)	POPULATION	AREA (acres)
Residential	5,347		26,291	1,381
Commercial		546,600		223
Industrial		1,191,200		479
Agriculture				21,838
Public				153
Thermal Airport		45,000		291
Watercourse ¹				1,638
Transportation				1,205
Vacant				26,322
TOTALS	5,347	1,782,800	26,291	53,530

¹ Includes rights-of-way associated with the Coachella Valley Storm Channel and All-American Canal.

² Based on Dept of Finance 1995 data for Coachella with calculation for unincorporated area based on d.u.s and 4.755 average household size.

As shown in the preceding Table and Figure, the predominant existing land use within the Planning Area is agriculture with nearly 22,000 acres representing approximately forty percent (40%) of the Planning Area. Also significant, the Planning Area contains nearly 26,322 acres (50% of the study area) of vacant land. The largest single block of vacant land is east of the All-American Canal in the Mecca Hills, containing over 6,000 acres. Other large blocks of vacant land are located within the valley area on Indian lands and within Thermal Airport property. Various residential uses constitute about 1,400 acres making up approximately three percent (3%) of the overall acreage. Of this three percent, Multi-family residential accounts for only about 15 percent. There are also scattered commercial uses (about 225 acres), mainly along regional transportation corridors, and various industrial uses including auto wrecking, food packing/shipping operations as well as other agriculture related businesses (about 480 acres). Public uses, including existing schools, churches, and other governmental or institutional uses, comprise approximately 153 acres. Total Public land uses constitute less than 1% of the Planning Area. The study area also contains approximately 3,077 acres (6%) of rights-of-way associated with roadways and watercourses including the Coachella Storm Water Channel and the All-American Canal. Of the total Planning Area, approximately 40,357 acres are within unincorporated Riverside County, making up 67 percent (67%) of the project area. Incorporated lands consist of all property within the current City Limits of Coachella totaling approximately 13,174 acres and making up the remaining 33 percent (33%) of the Planning Area.

Relevant Planning Documents

General Plans of the Planning Area

The Study Area for the project contains both unincorporated Riverside County lands as well as the incorporated City of Coachella. Therefore, the designation and distribution of land use within the Study Area is presently regulated by the Riverside County General Plan and the existing City of Coachella General Plan. A statistical summary of buildout under these existing general plans is presented in Table 3.1-2, Existing (1996) Regulatory Land Use Summary.

Table 3.1-2 Existing (1996) Regulatory Land Use Summary (Land Use at buildout under City and County General Plans)				
LAND USE	DWELLING UNITS	BUILDING AREA (sf)	POPULATION ³	AREA (acres)
Residential	9,662		29,369	4,128
Commercial ¹	1,132	2,917,900	3,441	753
Industrial		65,813,500		5,769
Agriculture ¹	986	48,100	2,997	21,261
Public ²				3,230
Desert ¹	480		1,459	12,013
Thermal Airport		3,765,700		2,273
Specific Plans	17,350	2,464,300	52,774	4,103
TOTALS	29,610	75,009,500	90,040	53,530

¹ Allows residential: a assumes 15 du/ac within portions of "Commercial", 1 du/20 ac within "Agriculture" and 1 du/10 ac within "Desert".

² Includes rights-of-way associated with public roads and watercourses including the Coachella Valley Storm Channel and All-American Canal.

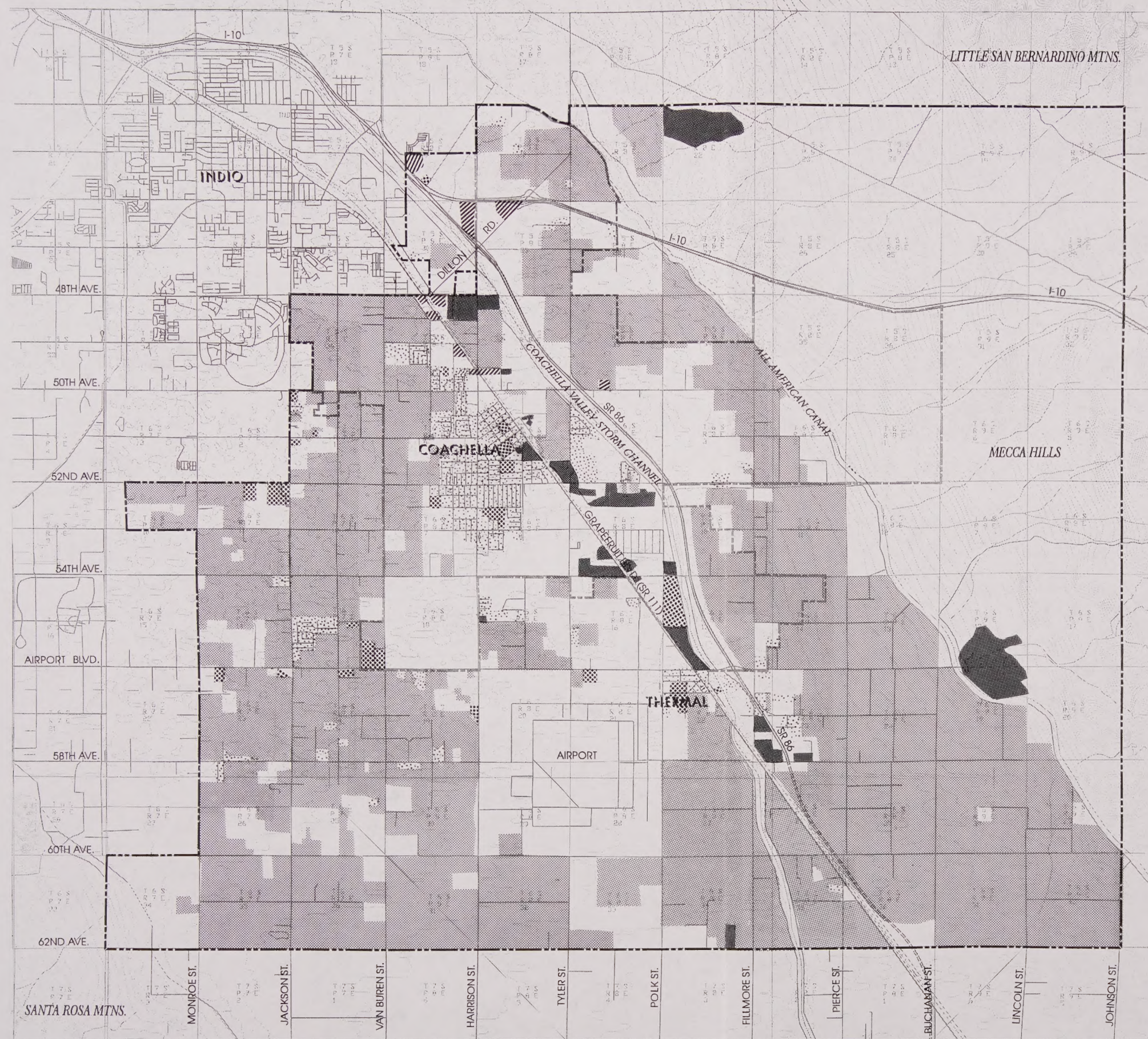
³ Population projection assumes average household size of 3.2 persons.

CITY OF COACHELLA

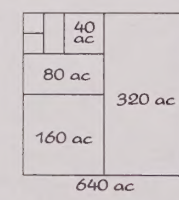
GENERAL PLAN

EIR

Existing Land Use



- Residential
- Agriculture (Includes residences)
- Industrial
- Commercial
- Public
- Vacant



Source:
Feb. 1996 Land Use Survey,
Smith, Peroni & Fox

Smith, Peroni & Fox, Planning Consultants, Inc.
225 S. Civic Dr. Suite 1-5 Palm Springs, CA 92262

Figure No. 3.1-1

Riverside County. As shown on Figure 3.1-2, Riverside County Existing General Plan Land Use, the majority of the unincorporated portion of the Study Area is designated for agriculture with some industrial and commercial designations near the Thermal Airport and the corporate boundaries of Coachella. The Mecca Hills portion of the planning area is designated as "Desert Areas" which allows one dwelling unit per 10 acres. Residential land use designations are generally located in the Thermal area and south of the Indio city limits. Residential densities range from .2 dwelling units per acre to 5 dwelling units per acre.

City of Coachella. Within the incorporated City limits of Coachella, land use is under the jurisdiction of the Coachella General Plan. The previous General Plan was adopted by the City in January 1987. As shown in Figure 3.1-3, City of Coachella Existing General Plan Land Use, there are a variety of land use designations including agriculture, three different residential densities, light and general industrial, desert, resort, public/quasi public and approved specific plans.

General Plans of Adjoining Jurisdictions

General Plans of surrounding jurisdictions may also affect the planning area. These include the Cities of Indio and La Quinta, discussed below:

City of Indio. The Indio General Plan was adopted in October 1993 and borders the Coachella Planning Area on the west between Avenue 44 and Avenue 52. The Indio Plan proposes a variety of uses, most of which do not appear to conflict with any planned uses in Coachella. However, possible conflict could occur between Coachella's proposed Entertainment Commercial area, and Indio's proposed low density Country Estate designation which are adjacent to each other at the northern City Limits. Appropriate buffers and setbacks will need to be used to separate these two uses. Indio's Circulation Plan and its' relationship to this project is discussed in Section 3.5.

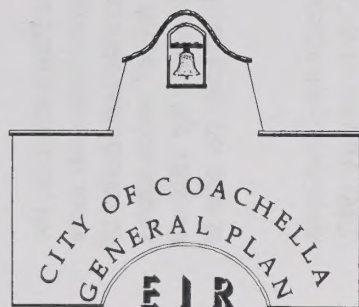
City of La Quinta. The La Quinta General Plan (adopted in October 1992) borders a portion of the western edge of the Coachella Planning Area along Monroe Street between Airport Boulevard and Avenue 53. The proposed land uses for both General Plans are compatible with each other since both call for Very Low Density Residential (0-2 DU/acre) in this area. A portion of the La Quinta General Plan along Monroe Street is designated as Low Density Residential (2-4 DU/acre) and does not, therefore, present any conflicts with the Coachella General Plan. La Quinta's Circulation Plan and its' relationship to this project is discussed in Section 3.5.

Riverside County. The Riverside County General Plan borders the project area on the north, east, and south. In general, County land uses contained within the study area are extended offsite including "Agriculture" to the south and "Desert Area" to the north and east. Some small areas of residential and commercial land uses border the southern boundary as well. Riverside County's Circulation Plan and its' relationship to this project is discussed in Section 3.5.

Regional Plans

The following documents are regional in nature and also have relevance to the Planning Area.

Southern California Association of Governments (SCAG) Regional Comprehensive Plan and Guide (1995). This document is a compilation and summary of regional plans with input from numerous local, regional, and federal agencies. It summarizes the plans which describe how the region will meet certain federal and state requirements with respect to Transportation, Growth Management, Air Quality, Housing, Hazardous Waste Management and Water Quality Management. It also sets a broad set of goals for the region, and identifies strategies for agencies at all levels to use in guiding their decision making process. A selection of some of the regional plans which this report is based on are summarized below.

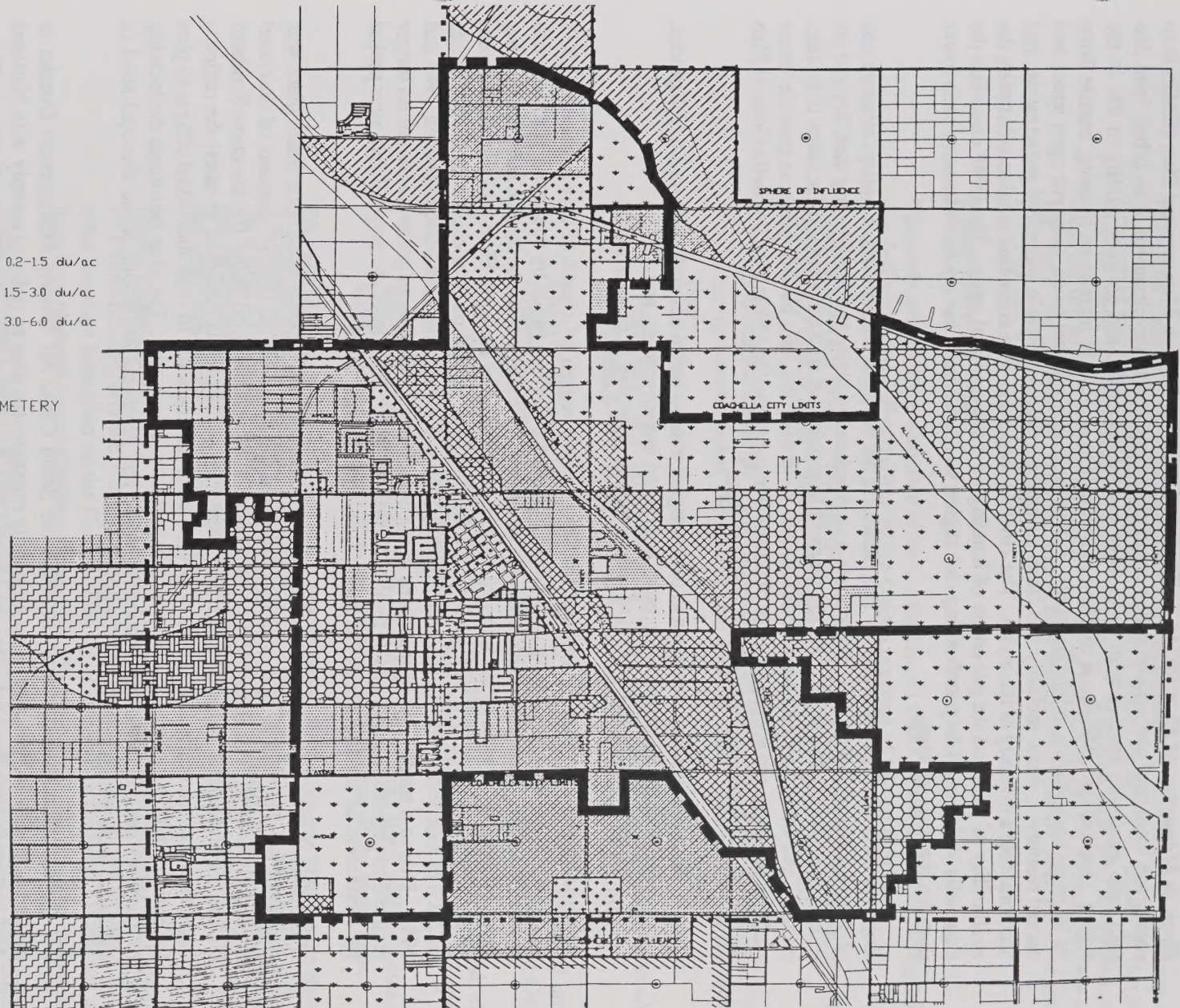


Smith, Peroni & Fox, Planning Consultants, Inc.
225 S. Chic Dr. Suite 1-5 Palm Springs, CA 92262

Figure No. 3.1-2

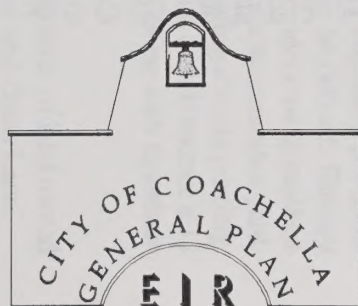
LEGEND

	AGRICULTURE	
	DESERT	
	RURAL RESIDENTIAL	0.2-1.5 du/ac
	SUBURBAN RESIDENTIAL	1.5-3.0 du/ac
	URBAN RESIDENTIAL	3.0-6.0 du/ac
	RESORT	
	GENERAL COMMERCIAL	
	PUBLIC/QUASI PUBLIC CEMETERY	
	LIGHT INDUSTRIAL	
	GENERAL INDUSTRIAL	
	SPECIFIC PLAN	
	AIRPORT	



Source: City of Coachella

N Not to Scale



City of Coachella Existing General Plan Land Use

Smith, Peroni & Fox, Planning Consultants, Inc.
225 S. Civic Dr. Suite 1-5 Palm Springs, CA 92262

Figure No. 3.1-3

Growth Management Plan (SCAG). The purpose of the Growth Management Plan (GMP) is to encourage local land use actions which could ultimately lead to development of an urban form that will help minimize development costs, save natural resources, and enhance quality of life in the region. Goals of the GMP aim at enabling individuals to spend less income on housing, enable firms to be more competitive, minimize public and private development costs, preserve open space and natural resources, attain mobility and clean air quality, avoid economic and social polarization, and accommodate a diversity of life styles. The GMP is concerned with achieving a balance between the availability of jobs and the provision of housing on a sub-regional basis. The GMP classifies the Coachella Valley as a jobs poor/housing rich region which means it has a jobs to housing ratio lower than the regional average.

Regional Mobility Element (SCAG). This element is the principal transportation policy, strategy and objective statement of SCAG. It proposes a comprehensive strategy for achieving mobility and air quality mandates. The RME lists the planned improvement to transportation facilities that state, county, and other agencies have committed to fund over the next twenty years to provide better mobility of people and goods. In terms of potential impacts resulting from the Coachella General Plan update, the relevant portions of the RME state that:

- Adequate capacity must exist in the subregion transportation network to absorb development,
- Funds must be generated to pay for required improvements, and
- All measures must be taken to reduce vehicle trips and peak hour traffic.

Regional Housing Needs Assessment (RHNA). As the region's Council of Governments (COG), SCAG is charged with developing projections of regional housing needs by economic group in each jurisdiction. This determination identifies the SCAG region's share of the statewide need for housing and is intended to be used by each jurisdiction in developing its Housing Element. The most recent RHNA for the project area was prepared by the Southern California Association of Governments (SCAG) in June 1988. The RHNA was originally prepared for the five year period between 1989 and 1994. Due to a suspension of mandates in the State budget, councils of government are no longer required to prepare assessments of regional housing needs. Therefore, the original five year period for attainment of housing needs has been extended until June 1998.

Hazardous Waste Plan. The need for development of county and regional hazardous waste plans was triggered by state and federal laws that mandated the phase-out of landfill disposal of unrelated hazardous wastes. The Hazardous Waste Plan of 1989 was prepared under the direction Southern California Hazardous Waste Management Authority. This plan is designed to assist the region's counties and cities, regional councils of government, and the state, in their individual efforts to plan for current and future hazardous waste management requirements. The plan facilitates the locating of facilities needed to manage hazardous waste and promotes hazardous waste disposal sited in industrial areas where such waste is generated.

Air Quality Management Plan. In 1989, the South Coast Air Quality Management District in association with SCAG adopted an air quality management plan in order to comply with National Ambient Air Quality Standards. This plan was updated in 1991 to comply with the California Clean Air Act. The purpose of the plan is to set forth a comprehensive program that will lead the Basin into compliance with all federal and state air quality standards. It includes a number of control measures aimed at reducing air pollution and improving the environment. Compliance with the AQMP is discussed in Section 3.6, Air Quality.

1989 California Integrated Waste Management Plan. Assembly Bill 939 was passed by the California Legislature in 1989 to address the solid waste issue. This act requires local governments to prepare comprehensive plans to reduce the amount of solid waste disposed of in landfills by 25 and 50 percent by the years 1995 and 2000, respectively.

Coachella Valley Fringe Toed Lizard Habitat Conservation Plan. This plan is a cooperative federal and local program of conservation for the Coachella Valley Fringe Toed Lizard a “threatened” animal species under the Federal Endangered Species Act. The plan analyzes current and historic habitat areas for the species and establishes a fee area or use in acquiring a habitat preserve to compensate for “take” of the species. The fee area occurs within the Planning Area north of the Interstate 10 Freeway and west of Polk Street.

Other Relevant Plans

The study area contains a number of locally significant plans which dictate or strongly influence land use designation and distribution within certain portions of the study area.

Approved Specific Plans. Five approved Specific Plans lie within the Planning Area and have been incorporated as part of the Coachella General Plan Update. These include:

- ***McNaughton Specific Plan*** - 8,000 dwelling units along with commercial, hotel/lodge, golf course, recreational and open space uses on 1,877 acres of land in the incorporated City limits.
- ***Brandenburg and Butters Specific Plan*** - 1,481 dwelling units along with commercial and public uses on 349 acres of land within the incorporated City limits.
- ***Lusardi (Rancho Coachella Vineyards) Specific Plan*** - 1,085 dwelling units along with commercial and public uses on 260 acres of land within the incorporated City limits.
- ***Promenade Park Specific Plan*** - 4,720 dwelling units along with commercial, office, and park uses on 792 acres of land in both the incorporated City limits and the unincorporated County.
- ***Rancho La Quinta Specific Plan*** - 2,064 dwelling units along with golf course uses on 826 acres of land within the unincorporated County portion of the study area.

Thermal Airport Master Plan (1990). The Thermal Airport Master Plan covers slightly more than four square miles of land surrounding the existing Thermal Airport, a general aviation airport serving the greater Coachella Valley. The Airport Master Plan documents the existing airport facilities and sets parameters for future expansion of runways, airfield facilities, terminal areas, airspace structure and associated airport support industries.

Indian Tribal Lands. Lands controlled by various Indian tribes, including the Cabazon Indians, the 29 Palms Indians, and the Augustine Indians, are located within the study area. The boundaries of tribal lands are identified on the General Plan Land Use Policy Diagram. While not all Indian lands have been planned, some significant planning efforts have been initiated on Indian lands including:

Fantasy Springs Casino and Recreation Plan - The Cabazon Indians control approximately 200 acres of land north of the Interstate 10 Freeway which presently contain the existing 64,000 s.f. Fantasy Springs Casino, a 7,000 s.f. administrative building, a 3,500 s.f. daycare center, outdoor swap meet on 13 acres, 3,000 s.f. fire department, 1,000 s.f. environmental testing lab, and 5 acres maintenance yard. A 127,000 s.f. addition to the existing casino including casino, showroom, and bowling alley is pending. More distant planned uses include an hotel with two 200 rooms towers for a total of 400 rooms, a 35 acre recreational vehicle park, a 15 acre theme park and a 160 acre, 18 hole Golf Course with timeshare condominiums (assumes additional land acquisition).

Indian Sands Community Planned Unit Development - 994 dwelling units on 165 acres of land owned by the Cabazon Indians roughly bordered by Avenue 48, Avenue 50, Tyler Street and Oates Lane.

Bureau of Land Management Mecca Hills Wilderness Area. The Wilderness Act was passed by Congress in 1964 and established the National Wilderness Preservation System, which is composed of federally owned areas designated by Congress as wilderness. The California Desert Protection Act was one of the largest wilderness acts passed by Congress and gives special wilderness designation to 69 individual BLM areas including the Mecca Hills Wilderness Area, which encroaches within the southern boundary of the Planning Area. In total, the Mecca Hills Wilderness Area encompasses 24,200 acres of land, of which only about 800 acres lie within the study area. Those lands within the study area contain private holdings in addition to federal.

Enterprise Zone

The Coachella Valley Enterprise Zone was established November 11, 1991 and is comprised of 28,300 acres. Enterprise zones have been established to give California business financial incentives to increase their net profit. Through State income tax credits, as well as investment and employment incentives, businesses physically located within zones can significantly reduce their California income tax obligation for up to fifteen years. Local government, at both the county and municipal level, have gone further and committed themselves to "fast tracking" site plans for projects of a "manufacturing or industrial nature".

Specifically, the Coachella Valley Enterprise Zone offers:

A hiring tax credit that allows Enterprise Zone businesses to take 50% of their "qualified", new employees first years wages as a tax credit with additional tax credits through the fifth year of employment; a net operating loss carry forward; a business expense deduction; a net interest deduction for loans made to zone businesses; tax credits for employees in zone businesses; and sales leads for enterprise zone businesses.

The Coachella Valley Enterprise Zone also offers local inducements for manufacturers and other businesses interested in a Zone location. These include: forty-five day fast track permitting for site plans of an industrial nature in Indio, Coachella and Riverside County; forty-five day fast track permitting through the Riverside County airport land use commission; waiver of industrial development bond application fees in Riverside County, Indio, and Coachella; waiver of airport land use commission staff processing fees for projects within the Zone; and a 1% reduction in business license fees for the first three years to all new businesses within Indio and Coachella.

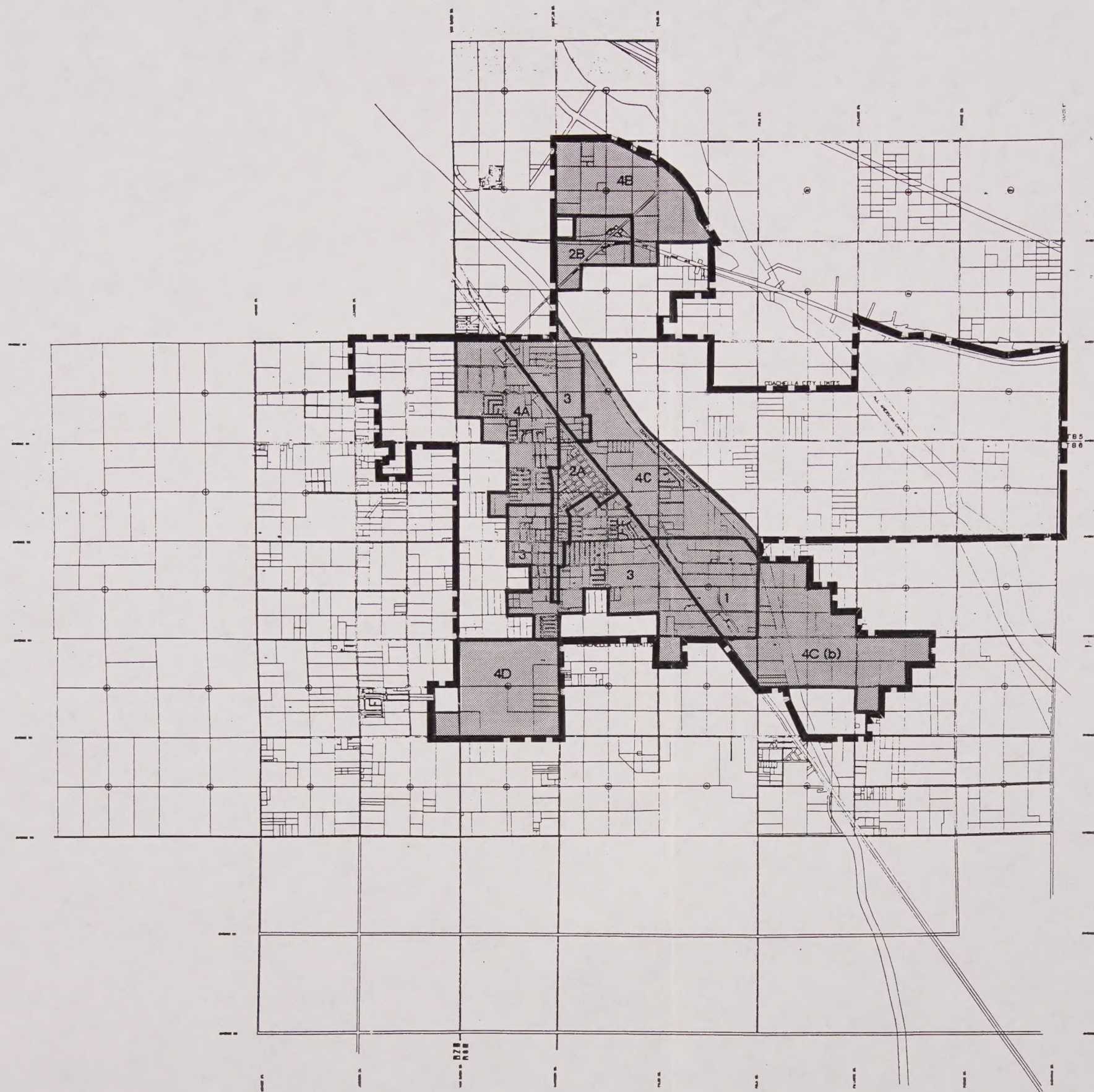
Redevelopment Plans. In December 1994, the Coachella Redevelopment Agency enacted Redevelopment Plans for four project areas. These areas were established to address conditions of blight including unsafe/dilapidated buildings, incompatible uses, irregular or inadequate lot sizes, inadequate public infrastructure, lack of commercial facilities and residential overcrowding. These Project Areas are shown on Figure 3.1-4, City of Coachella Redevelopment Program, and the following discussion summarizes key goals of each project area.

- **Project Area No. 1** - Circulation improvements within and leading to project area, drainage improvements providing for construction, repair or improvement of flood control facilities, public utility improvements that would provide for undergrounding of utilities, economic development which will remove blight, fund capital facilities improvements, and expand businesses.
- **Project Area No. 2** - Increase sewage capacity of treatment plant serving project area, sixth Street improvements including sidewalk, curb and gutter improvements, and street light improvements, Dillon Road and I-10 freeway interchange to be funded through Measure "M" allocations, gas tax and infrastructure fees, Dillon Road utility improvements providing for undergrounding of utilities such as water, sewer, gas, electricity, telephone and cable TV, Dillon Road fire station, Avenue 50 overpass for railroad/vehicular separation, Public



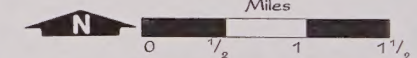
City of Coachella Redevelopment Program

-  Coachella City Limit Boundary
-  Redevelopment Project Areas



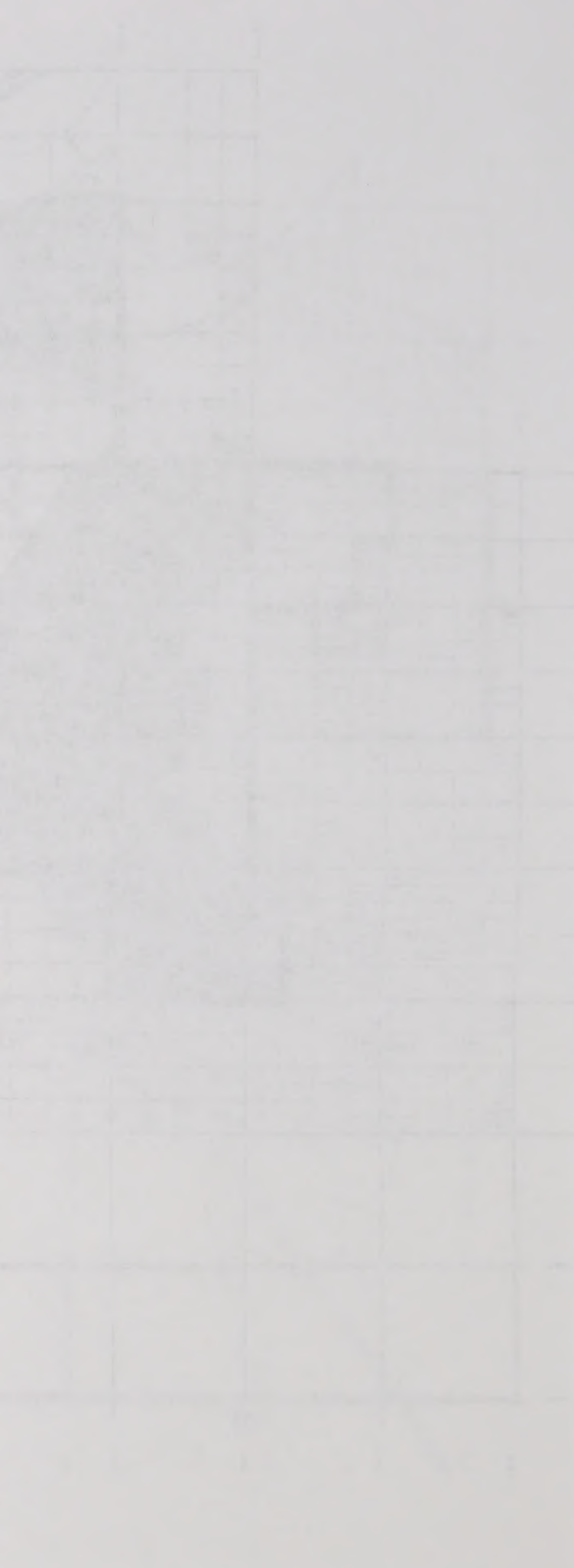
		40 ac	320 ac
80 ac			
160 ac			
640 ac			

Source:
City of Coachella Dept. of
Community Development



Smith, Peroni & Fox, Planning Consultants, Inc.
225 S. Civic Dr. Suite 1-5 Palm Springs, CA 92262

Figure No. 3.1-4



The following table shows the results of the experiment. The first column gives the time in seconds, and the second column gives the distance in feet. The third column gives the velocity in feet per second, and the fourth column gives the acceleration in feet per second squared.

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facilities improvements providing for construction, reconstruction, repair or improvement of libraries, schools, and civic center buildings including police and fire stations, flood control and drainage improvements including repair or improvement of channels, bridges and flood drains.

- *Project Area No. 3* - Public street right-of-way improvements including intersection improvements, sidewalk projects, street reconstruction, and signal realignment, sewage capacity improvements of existing treatment plant or the installation and construction of one or more additional sewage treatment facilities, public school improvements providing construction, reconstruction, repair or improvement of public school buildings, government building improvements including construction, reconstruction, repair or improvement of libraries and public administration buildings, including police and fire stations, flood control and drainage improvements including repair or improvement of channels bridges and flood drains, capital parks projects including Bagdouma Park and Dateland Park improvements.
- *Project Area No. 4* - Public street right-of-way improvements for vehicular and pedestrian traffic, sewage capacity improvements of existing treatment plant or the installation and construction of one or more additional sewage treatment facilities, public school improvements providing construction, reconstruction, repair or improvement of public school buildings, government building improvements including construction, reconstruction, repair or improvement of libraries and public administration buildings, including police and fire stations. The total cost of these improvements is not budgeted at this time, flood control and drainage improvements including repair or improvement of channels bridges and flood drains, capital parks improvements providing construction of new park amenities and improvement of existing park facilities within the project area.

Comparison of Land Use Changes

Figure 3.1-5, General Plan Land Use Policy Diagram, illustrates the location and types of land uses proposed throughout the Planning Area. This section provides a comparison of these proposed land uses with existing physical and regulatory land use conditions described previously in order to assess the potential impacts of the proposed project.

The proposed General Plan will guide future development by allowing property owners to pursue further development entitlements consistent with the General Plan land use diagram and General Plan policy guidelines. Implementation of the project will therefore encourage potential changes in land use location and intensity compared with existing conditions. Table 3.1-3 below, provides a summary of general land use designations at buildout of the Coachella General Plan update.

Table 3.1-3 Coachella General Plan Update Land Use Summary				
LAND USE	DWELLING UNITS	BUILDING AREA (sf)	POPULATION ⁴	AREA (acres)
Residential	29,577		89,913	14,704
Commercial ¹	2,974	4,059,000	9,041	3,960
Industrial		50,983,000		4,528
Agriculture ¹	596		1,812	14,563
Public ²		89,300		1,103
Open Space ³				7,090
Thermal Airport		3,765,700		2,273
Specific Plans	17,350	2,464,300	52,744	4,103
Transportation				1,206
TOTALS	50,497	61,361,300	153,510	53,530

¹ Allows residential: assumes 15 du/ac within portions of "Commercial", 1 du/40 ac within "Agriculture"

² Includes 640 acre County owned parcel in Mecca Hills.

³ Includes BLM Mecca Hills ownerships and Coachella Valley Storm Channel and All-American Canal rights-of-way

⁴ Population projection assumes average household size of 3.2 persons.

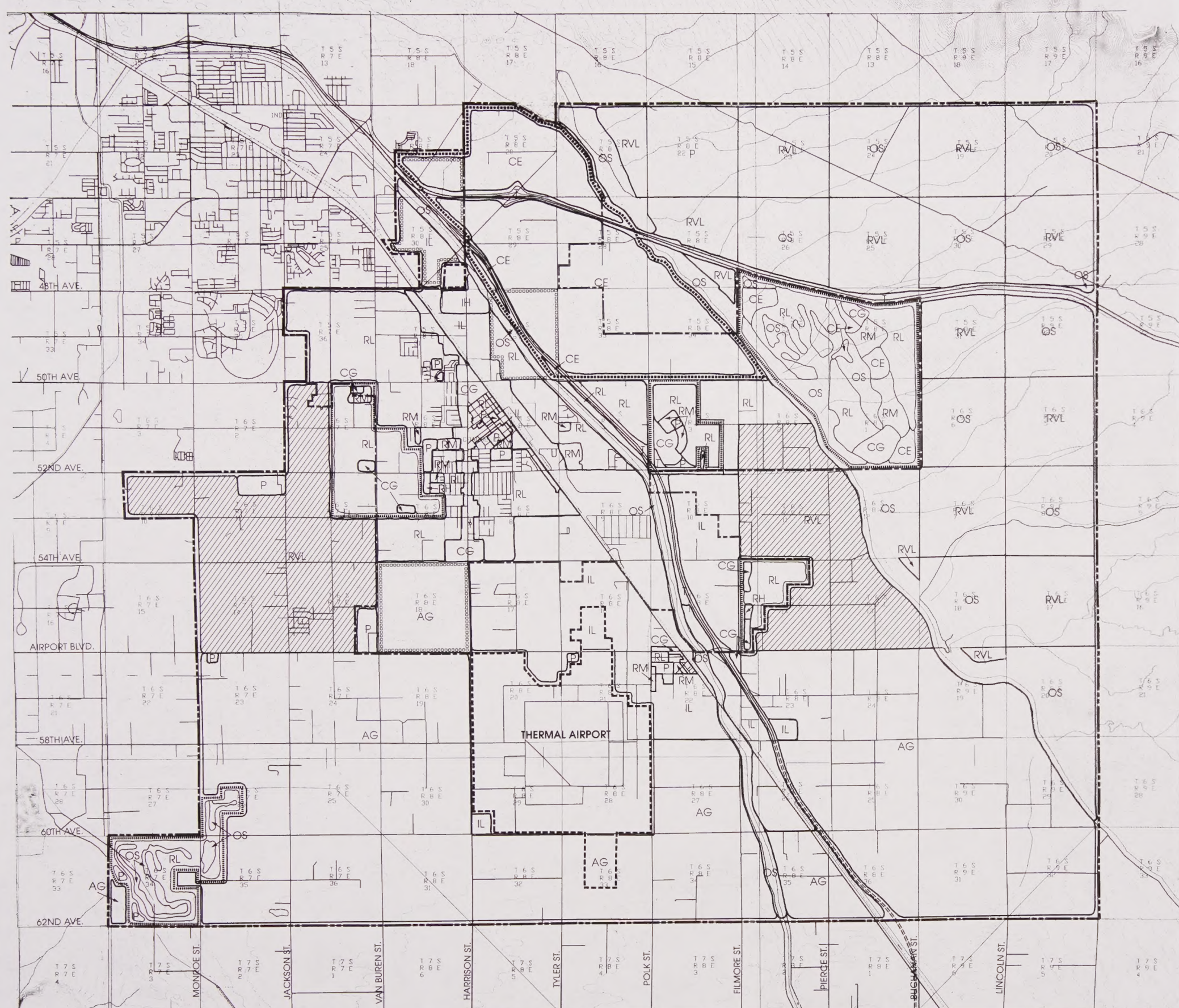
Table 3.1-4 below, compares existing conditions in the Planning Area to buildout conditions under the existing General Plans and the General Plan Update. This comparison is intended to show the relative magnitude of difference at buildout between the existing General Plans and the General Plan Update. As shown in the table, the proposed General Plan could potentially add approximately 15,777 residential acres and up to 7,786 non-residential acres (i.e., commercial and industrial uses) within the Planning Area at buildout. In comparison with buildout of existing General Plans, the proposed project would add about 58% more residential units but would reduce non-residential building square feet by about 18% thus improving the balance between employment and housing within the study area when compared to the balance under existing General Plans.

Table 3.1-4 Net Change in Development Existing Conditions vs. Existing & Proposed General Plans				
BUILDOUT SCENARIO	RESIDENTIAL ACRES	CHANGE FROM EXISTING (AC)	RESIDENTIAL UNITS	CHANGE FROM EXISTING (DU)
Existing Cond.	1,381		5,347	
Existing G.P.	6,582	5,201	29,608	24,261
Proposed G.P.	17,158	15,777	50,497	45,150
BUILDOUT SCENARIO	COMM / INDUS ACRES	CHANGE FROM EXISTING (AC)	BUILDING SQUARE FEET	CHANGE FROM EXISTING (SF)
Existing Cond.	702		1,738,300	
Existing G.P.	6,522	5,820	75,009,500	73,271,200
Proposed G.P.	8,488	7,786	61,361,700	59,623,400



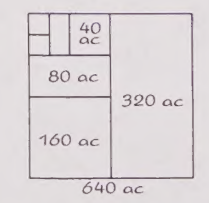
CITY OF COACHELLA GENERAL PLAN EIR

Land Use Policy Diagram



- AG Agriculture (1du/40ac)
- RVL Very Low Density Residential (0-2du/ac)
- RL Low Density Residential (0-6du/ac)
- RM Medium Density Residential (0-10du/ac)
- RH High Density Residential (0-20du/ac)
- RVH Very High Density Residential (0-30du/ac)
- CG General Commercial
- CE Entertainment Commercial
- IL Light Industrial
- IH Heavy Industrial
- P Public Use
- OS Open Space-Conservation
- T Transportation Facilities

- Planning Area Boundary
- Incorporated City Limits (March 1996)
- Approved Specific Plan
Within these areas, the approved Specific Plan is the official General Plan land use diagram, including maximum allowable residential densities and nonresidential intensities. Land uses depicted on the General Plan Land Use Policy Diagram which lie inside the Specific Plan boundary are illustrative only to show the general pattern of intended land use and its spatial relationship to adjacent properties. The Specific Plan should be consulted for a detailed understanding of allowable land uses and maximum densities/intensities.
- Entertainment Area Plan
This is an area of special interest to the City of Coachella which will be further refined through the use of implementing plans such as specific plans, planned unit developments and similar detailed plans.
- Tribal Land
Tribal Lands include properties under the control of Native American groups including the Colorado Indians, the 29 Palms Band of Colorado Indians and the Quechan Indians.
- Airport Master Plan
This area encompasses lands within the Thermal Airport Master Plan boundary. The Thermal Airport Master Plan is the official General Plan land use diagram for this area except where specific land uses are assigned within the master plan boundary on this General Plan Land Use Policy Diagram.
- Agriculture to Urban Transition Overlay



Source:
City of Coachella
Smith, Peroni & Fox

Figure No. 3.1-5

Figure 3.1-6, Agricultural Lands, depicts the general extent of agricultural lands within the Planning Area based on crop production and agricultural soil suitability according to the California Department of Conservation, Farmland Mapping and Monitoring Program. In general, with the exception of the Mecca Hills, the Thermal Airport, and urbanized areas in and surrounding downtown Coachella, most of the land within the Planning Area is suitable for agricultural production. Table 3.1-5 provides a general comparison of the amount of land by crop type which would be lost under buildout of Existing General Plans and under the Proposed General Plan Update. As shown, the existing Plans preserve approximately 93% (21,261 acres) of existing cropland while the Proposed General Plan Update preserves approximately 61% (14,563 acres).

Table 3.1-5 Comparative Loss of Agricultural Lands			
CROP	ACRES EXISTING IN 1996 ¹	ACRES RETAINED UNDER EXISTING GENERAL PLANS	ACRES RETAINED UNDER PROPOSED GENERAL PLAN UPDATE
Date	3,111	2,262	1,747
Citrus	2,243	1,941	700
Grapes	4,651	4,110	2,918
Field Crops	11,326	8,457	6,376
Miscellaneous	507	4,491	2,822
TOTALS	23,834	21,261	14,563

1. Table based on field surveys and review of aerial photography by Smith, Peroni, and Fox Planning Consultants, 1996.

Spatial Analysis: Proposed General Plan Compared with Existing (1996) Physical Land Uses

Differences between buildout conditions for the project and land use conditions as they currently exist can be determined by comparing the proposed General Plan Land Use Policy Diagram (Figure 3.1-5) and the Existing Land Use map (Figure 3.1-1). Areas of potential future growth are discussed in terms of geographical subareas of the Planning Area as shown on Figure 3.1-7, City of Coachella Planning Area. This figure also shows the incorporated City limits, the City's Sphere of Influence, and various governmental lands.

- Agricultural Preserve** - This is the area generally south of Airport Boulevard (excluding Thermal Airport) to the southern boundary of the Planning Area at Avenue 62. This subarea includes the Augustine Indian Reservation, which is currently vacant land, northwest of Thermal Airport and the unincorporated community of Thermal. The existing land use of this subarea is primarily in agricultural production, most of which will continue as agriculture under the proposed plan. Urban land uses are, however, recognized and accommodated in the areas around Thermal and within the approved Rancho La Quinta Specific Plan in the southwest corner of the Planning Area which contains residential golf course development.
- Thermal Airport** - This is the approximate four square mile area surrounding the Thermal Airport operations and includes lands within the Airport Master Plan boundaries. The existing airport is a general aviation facility with two runways, a terminal building, fire station, aircraft hangars and parking, aircraft fueling and other related facilities. The Thermal

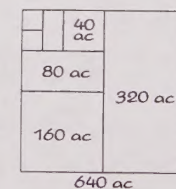
Airport Master Plan provides for future expansion of the airport which, depending on demand could include an expanded runway to accommodate cargo and commercial carriers, as well as various compatible industrial uses.

- **Mecca Hills** - That portion of the Planning Area east of the All American Canal. Existing land use of this area is primarily undisturbed rolling desert lands, but includes some areas disturbed by various mining claims (about 150 acres), agriculture (180 acres) and the Coachella Landfill which presently contains about 75 acres of disturbed area. Governmental lands in this area, including the All- American Canal right-of -way, will be designated Open Space-Conservation, but would allow other uses consistent with policies of the governmental agency having jurisdiction (i.e., Bureau of Land Management, Bureau of Reclamation). The Majority of private lands in the Mecca Hills would be designated Very Low Density Residential which allows up to two dwelling units per acre. This area also includes the McNaughton Specific Plan which is a mixed use project allowing up to 8,000 residential units along with various commercial and recreational components. Riverside County presently leases 640 acres from the BLM which includes the 75 acre landfill footprint but plans to close the facility in the near future due to seismic concerns. The County plans to purchase the entire site from BLM but has no definite plans for its reuse other than a potential Material Recovery Facility but this would affect only a small portion of the overall acreage. Since most of the land is undisturbed, it could accommodate a variety of uses.
- **Downtown**- Generally bounded by Avenue 54 on the south, Van Buren Street on the west, and Grapefruit Boulevard (Highway 111) on the east. This area contains a mix of agriculture, residential, commercial, industrial, and vacant land, but is mainly characterized by single-family residential and pockets of commercial uses. The majority of the downtown area will be designated as Low Density Residential, allowing up to 6 units per acre, as well as a substantial amount of commercial along Highways 111 and 86 and light industrial in the southeast portion of this subarea. Established single family residential neighborhoods are accommodated with appropriate designations on the Land Use Policy Diagram as are existing commercial and multi-family developments. Some future component of multi-family residential use would be allowed to develop within the commercial land use category.
- **East Coachella** - The area north of Airport Boulevard between the Coachella Valley Storm Channel and the All-American Canal. Currently, this area is almost exclusively in agricultural production with scattered residential and some vacant land. Indian Tribal lands containing two casinos and various support facilities occur in the northern portion of this subarea near the Interstate 10 Freeway. Building from and including the existing casinos, the north half of this area is proposed for a Commercial Entertainment designation. A Specific Plan will be prepared for this project in the near future, but anticipated uses include retail and restaurant uses, various hotels including a full service resort, outdoor recreation such as a waterpark, golf courses, equestrian center, multi-sport complex, general commercial uses as well as a residential component. The southern portion of this area is designated Low and Very Low Density Residential and Light Industrial and contains two approved specific plans.
- **Central Corridor** - The area north of Airport Boulevard between the Southern Pacific railroad tracks and the Coachella Valley Storm Channel. This area is a mixture of vacant, industrial, agricultural, public, and residential land uses. Packing houses and cold storage facilities in proximity to the railroad tracks and serving local agricultural needs are focussed in this area. With the proposed project, most of this area would be built out as Light Industrial, with some Low and Medium Density Residential and a relatively small amount of Heavy Industrial to recognize an existing auto wrecking operation.



Agricultural Lands

- P** Prime Agricultural Lands
- U** Unique Agricultural Lands
- S** Agricultural Lands of Statewide Importance
- D** Urban Lands
- G** Grazing Lands
- L** Agricultural Lands of Local Importance
- X** Other Lands
-  Williamson Act Lands "Agricultural Preserve"



Source:
California Dept. of Conservation,
Farmland Mapping & Monitoring
Program 1995.
Riverside County Assessors Office

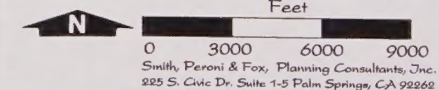
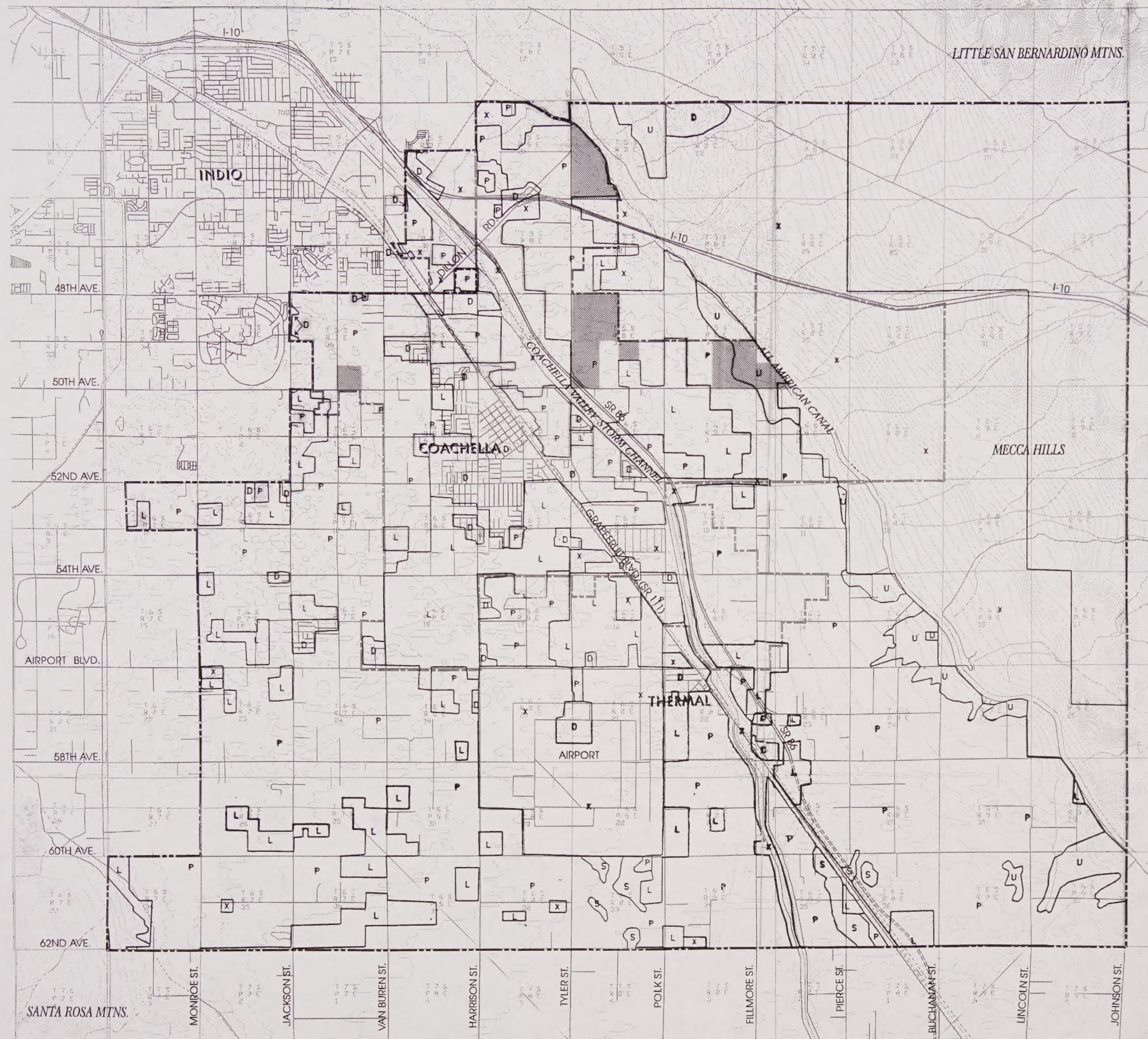
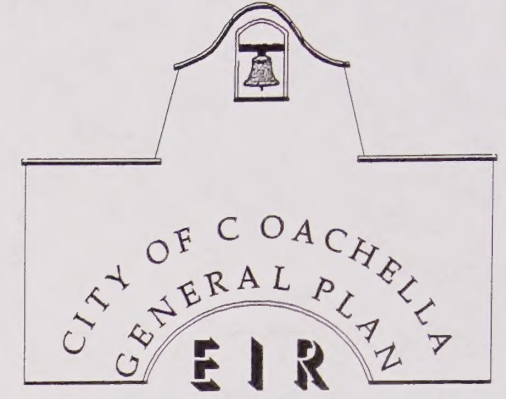
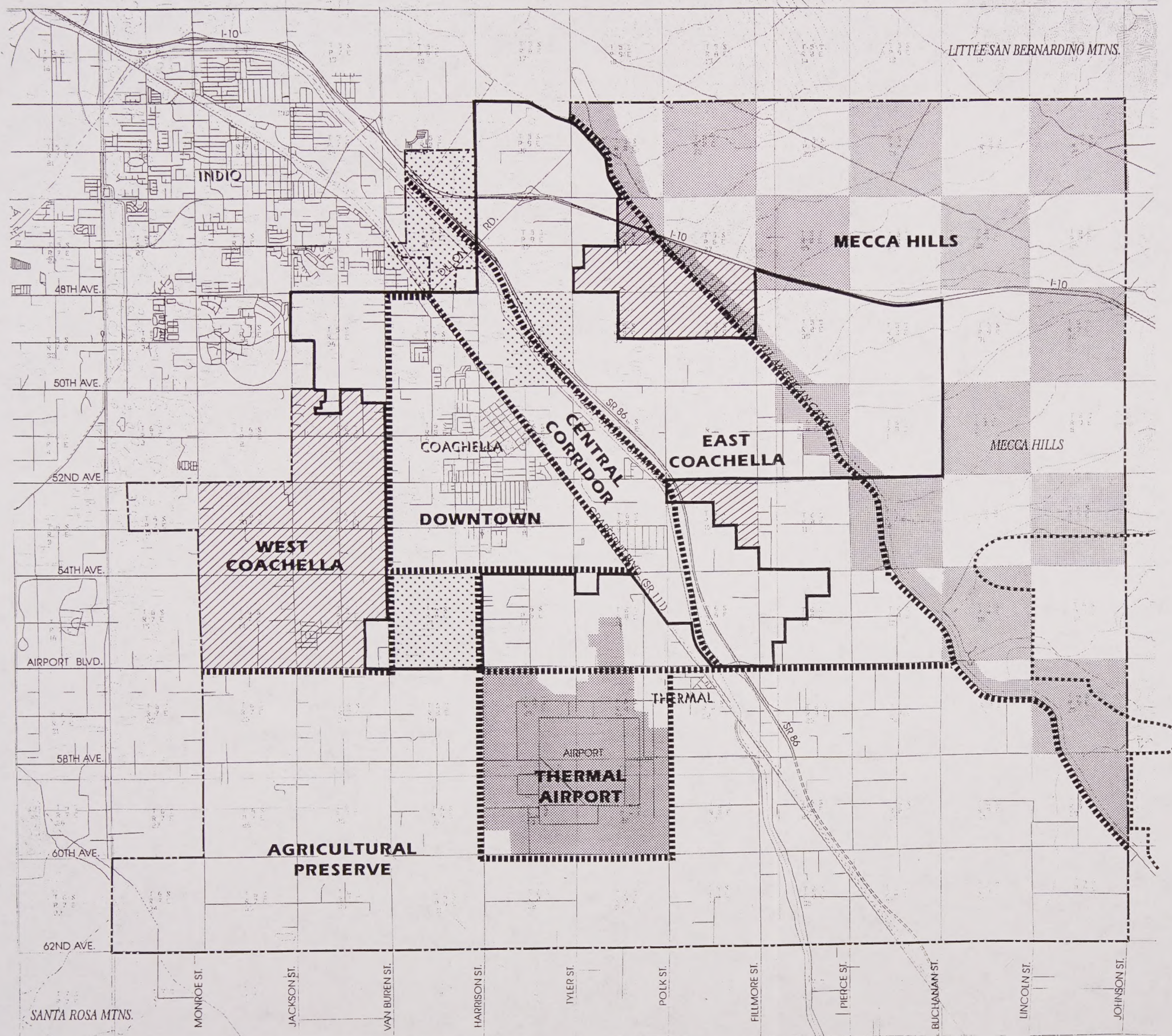


Figure No. 3.1-6



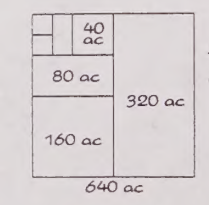




City of Coachella Planning Area

- Planning Area
- Incorporated City Limits
- Sphere of Influence
- Tribal Lands
- Mecca Hills Wilderness Area
- Government Lands*
- Planning Subareas

* Exclusive of R.O.W.'s easements & flood control facilities



Source:
LAFCO, City of Coachella

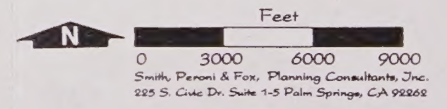


Figure No. 3.1-7



- **West Coachella** - The area north of Airport Boulevard from Van Buren Street to the western Planning Area boundary. This portion of the Planning Area is mostly in agricultural production at the present time but contains some palatial residential/equestrian estates. This area also has striking views of the Santa Rosa Mountains to the west. In keeping with the current trend of development while also retaining visual ties to agriculture, this subarea will be converted mostly to Low and Very Low Residential uses. An "Agricultural to Urban Transition Overlay" is also designated in this area which is designed to encourage the retention of agricultural elements within the greater fabric of urban development. A portion of this subarea also contains an approved Specific Plan which is designated primarily as Low Density Residential with a commercial and medium density residential component.

Spatial Analysis: Proposed General Plan Compared with Existing General Plans

The proposed General Plan Land Use Diagram differs from the existing City and County General Plan maps to varying degrees depending on Planning Area location. Differences between the General Plans can be determined by comparing Figures 3.1-2 and 3.1-3 (Existing County and City General Plans) to Figure 3.1-5 (Land Use Policy Diagram). The following comparison is again discussed by geographic subarea.

- **Agricultural Preserve** - This area is primarily designated for agricultural production under the proposed project while accommodating urbanization, including substantial industrial uses, in the Thermal area and residential/golf course development within the Rancho La Quinta Specific Plan at the southwest corner of the study area. These designations are consistent with the County General Plan which designates the majority of this subarea for agricultural use, designates manufacturing and other urban uses around Thermal and recognizes the Rancho La Quinta Specific Plan.
- **Thermal Airport** - The proposed Coachella General Plan Update is consistent with the County General Plan and incorporates the County Master Plan for the Thermal Airport.
- **Mecca Hills** - That portion of the subarea currently within the County's jurisdiction is designated on the existing County General Plan as "Desert Area", which is an open space and conservation category allowing one dwelling unit per 10 acres. The remainder of this subarea is within the incorporated Coachella City Limits and is designated as Specific Plan (McNaughton Specific Plan) under existing City land use. The proposed project is generally consistent with these designations, retaining the specific plan and designating a large portion of the area as Open Space-Conservation. However, approximately nine government sections of privately owned land in the Mecca Hills are designated "Very Low Density Residential" allowing up to 2 dwelling units per acre, a higher residential density than 1 du/acre allowed under the present County "Desert Area" designation..
- **Downtown** - The downtown area is entirely within the incorporated City limits. The existing City General Plan calls for a similar mix of uses as the General Plan update, including low density residential, general commercial along Grapefruit Boulevard (Highway 111) and Harrison Street, and light industrial in the southeast portion of the subarea. Pockets of multifamily residential are shown on the proposed General Plan to accommodate existing or approved multifamily development.
- **East Coachella** - That portion of the subarea currently within the County's jurisdiction is designated as Agriculture. That portion of the subarea within the existing City General Plan is designated Agriculture along the eastern portion of the subarea, General Industrial adjacent to the Coachella Valley Stormwater Channel, and General Commercial, Light Industrial and Suburban Residential in the northern areas. There are also two approved Specific Plans

(Brandenburg & Butters, Lusardi) in this subarea, which are recognized by both the existing and proposed City General Plans. The major difference in the proposed General Plan Update is that it designates the entire area north of Avenue 50 as Entertainment Commercial which would have anticipated uses as described in the previous section and would be a major departure from the land use designations on the existing General Plans. The two specific plans are incorporated along with a large amount of Light Industrial adjacent to the storm channel. The remainder of this area is designated as Low and Very Low Density Residential under the proposed General Plan.

- **Central Corridor** - This planning subarea is primarily within the City limits and is currently designated General Industrial along the railroad and Highway 111 and Light Industrial in the northern portion adjacent to the storm channel. The central portion of the subarea is designated Suburban Residential. The southern portion of this area is outside the City limits and is designated as light industrial in the existing City General Plan and Industrial/Manufacturing in the County General Plan. The proposed General Plan generally maintains consistency with these categories, assigning Light Industrial over much of this area. The primary exception to this occurs on a portion of Tribal land designated Light Industrial on the existing General Plan which is changed to Low Density Residential to better conform with the Indian Sands Community P.U.D. proposed for this area.
- **West Coachella** - This subarea is mostly outside the City limits but the majority is within the City's Sphere of Influence. Those portions within the incorporated City of Coachella are designated as Public, Resort, Suburban Residential, and Rural Residential on the existing City General Plan. There are no major changes proposed within the City portions of this area since the General Plan Update generally retains these designations. The current County General Plan, which covers most of this subarea, generally applies an agricultural designation with small enclaves of residential land use at rural and suburban densities. A portion of the approved Promenade Specific Plan also lies within the County. The Coachella General Plan Update is slightly more intense but consistent with these designations since it retains the Specific Plan designation with the remainder of the County area designated as Low and Very Low Density Residential with an "Agricultural to Urban Transition Overlay" designed to encourage the retention of agriculture to the maximum extent practical while allowing urbanization. A 240 acre portion of this subarea is within the Sphere of Influence of the City of La Quinta. While this area itself is not shown on the La Quinta General Plan, areas adjacent to it are designated Very Low Density Residential with a Rural Residential Overlay and would likely be applied to this area as well. The Coachella General Plan Update designates this area as Very Low Density Residential at similar densities and is thus consistent with La Quinta's designations.

Thresholds of Significance

CEQA does not give specific criteria for determining significant impacts regarding land use although Appendix G does give examples of what may constitute significant effects. For the purposes of this EIR, significant land use impacts may occur where a project would be incompatible with existing land uses in the vicinity, conflict with general plan policy (including applicable environmental policy), or affect agricultural resources or operations on prime agricultural lands.

Project Impacts and Mitigation Provided by Policy Diagrams

The Land Use Policy Diagram and other Policy Diagrams contained within the General Plan are intended to establish the general pattern of land use and identify supporting infrastructure needs throughout the Coachella Planning Area. Key elements which determine the layout of land uses and infrastructure which are intended to promote orderly patterns of development include the following:

- Existing viable residential neighborhoods have been designated with residential land uses intended to maintain existing densities.
- Existing Public facilities such as museums, schools, post offices, fire stations, landfills, and airports have been designated as "Public" (P).
- Areas of existing industrial use are maintained through application of the "Industrial" (IH, IL) designations.
- Preservation of existing agriculture is encouraged by application of the "Agriculture" designation and use of the Agriculture to Urban Transition Overlay.
- Preservation of watercourses and significant amounts of the Mecca Hills are accomplished through application of the "Open Space" designation.
- Consistency with various approved Specific Plans is maintained by incorporating them on the Land Use Policy Diagram.
- Tribal Indian Lands within the Planning Area are recognized by identification on the Land Use Policy Diagram .
- Recreational needs of residents are recognized and accommodated through the designation of open space and the identification of existing and potential parks and trails.

Project Impacts and Mitigation Provided by General Plan Policy

Buildout of the proposed General Plan could potentially create conflicts between adjacent land uses, both within the project area and adjacent to the project in surrounding jurisdictions. General Plan policies and goals are intended to ensure compatibility among land uses within the project area and beyond the project area into other jurisdictions. Internal consistency issues have been addressed throughout the proposed General Plan. These issues include the character and quality of the community, the distribution and compatibility of land uses, the intensity and types of housing, the provision of parks and recreational facilities, and the provision of public services and utilities.

The Land Use Element of the Coachella General Plan will set future direction for land uses in the City by implementing the Land Use Policy Diagram as well as the various goals and policies contained in the Element. The Land Use Element is contained in Section 3.1 of the General Plan with goals, policies and objectives for all major land use categories as well as special development areas within the City. Policies from other EIR chapters which are related to land use include the following :

1. Circulation Element policies relating to:
 - Maximum integration of land use and circulation systems.
 - Minimizing disruption of established land uses by proper design of circulation improvements.
 - Monitoring of land use impacts on circulation system capacity and function not to exceed minimum Level of Service D.
 - Encouragement of mixed use development to facilitate pedestrian travel.
2. Urban Design Element policies relating to:
 - The establishment of buffering guidelines between residential and non residential uses.
 - The use of roadways, fencing, setbacks and landscaping as buffers between residential and non residential uses.
 - The screening of unsightly site and building features from public view.
 - Architectural and landscaping guidelines to create interesting and attractive developments.

3. Open Space and Parks Element policies relating to:
 - Provisions of park and open space systems.
 - Protection of significant man-made or natural features.
 - Preservation of areas with safety constraints and sensitive environmental resources.
 - Preservation of sufficient agricultural lands to maintain agriculture as a viable industry.
 - Provision of adequate park and recreation facilities.
 - Coordination with the school district on integrating improved park facilities and school sites.
4. Agricultural Element policies relating to:
 - The retention of prime agricultural lands.
 - The maximum preservation of date palm groves, citrus groves, and vineyards.
 - The reduction of conflicts between agricultural and non-agricultural land uses.
 - The use of clustering and buffers to separate new residential from agricultural uses.
5. Conservation Element policies relating to:
 - Minimizing alteration to natural topography.
 - Preserving significant historic, archaeologic, and cultural sites.
 - Limitation of land use in water course and stormwater areas to recreational and other compatible uses.
 - Protection of significant mineral resources.
6. Environmental Hazards and Safety Element policies relating to:
 - Development setbacks from active and potentially active faults.
 - The restriction of critical facilities (hospitals, school, fire, police) from areas subject to geologic hazards.
 - Protection of development from stormwater and seismic induced flooding.
 - Protection of development from fire hazards.

Potential land use conflicts with adjoining jurisdictions have been addressed by the Proposed General Plan through policies which require coordination between the City of Coachella and surrounding jurisdictions or regional agencies. In implementing these policies, impacts can be reduced to a level of nonsignificance within the Planning Area and surrounding jurisdictions. For example, the following policies in the General Plan are intended to mitigate these impacts:

General Plan Land Use policies require the City to coordinate with LAFCO and surrounding jurisdictions to accomplish community growth in an orderly fashion and to coordinate with local Native American Indian tribes to achieve mutually compatible land uses on adjacent properties. Circulation Element policy requires the City to actively coordinate street width, alignment, classification, and intersection design with adjacent jurisdictions.

While the General Plan contains policies encouraging the preservation of agricultural lands, the proposed plan will result in a potential net loss of 9,271 acres (39%) of agricultural land within the Planning Area. The loss of agricultural land is considered a significant impact of the proposed project which cannot be entirely mitigated.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. Only the loss of agricultural land is considered a significant unmitigable adverse land use impact as a result of General Plan implementation. The relevant sections of this EIR should be consulted for a detailed discussion of related environmental issues and topics.

3.2 Geology, Soils And Seismicity

The following text is a summary of the *Seismic and Geologic Technical Appendix to the Safety Element for the City of Coachella General Plan Update* prepared for this project by Steven C. Suitt and Associates. The complete report, including its appendices appear as Appendix B in the Technical Appendices to this EIR, bound separately.

Regional Geologic Context

The regional geologic history of the Coachella Valley area is important to understand and consider for planning purposes because there are several direct cause-and-effect relationships between the geologic formation of the region and the resulting local seismic and geotechnical hazards. The geologic forces that produced the mountains and valleys that define the Coachella General Plan area also produced features that pose hazards to the people living in this area. Consequently, by understanding how and why these features formed, related geotechnical hazards can be more accurately addressed and evaluated in terms of their impact on future planning in the Coachella area.

Based on it's tectonic setting, southern California is located on the boundary of two lithospheric plates: the Pacific plate and the North American plate. Movement along these two plate boundaries causes earthquakes or "seismicity" primarily when the northwest motion of the Pacific plate slides past the North American plate in what is termed right-lateral transform "strike-slip" motion. The surface expression or boundary between these two plates is evident by the northwest trending system of faults known as the San Andreas fault system, which runs from the San Francisco area to the Bombay Beach area of the Salton Sea and includes the Coachella Valley segment of the San Andreas fault within the eastern portion of the Planning Area.

The seismic activity in the central portion of the Coachella Valley and the Coachella Valley segment of the San Andreas fault has been relatively low, compared to other parts of southern California. Most earthquakes that have been experienced in the Coachella basin area have occurred on other regional fault zones, such as the Mission Creek segment of the San Andreas fault, San Jacinto, Elsinore and Imperial faults. The implications of such low seismicity in the Coachella Valley are not certain. However, based on available data, such as recurrence intervals, a significant magnitude earthquake on the Coachella Valley segment of the San Andreas fault is likely to occur sooner than later. Table 3.2-1 is a list of selected historical earthquakes in southern California of magnitude M5.5 or greater that have produced ground shaking in the Planning Area.

Table 3.2-1. Selected Historical Earthquakes in Southern California

Earthquake	Date	Length of Fault (Km) (*)	Duration at Epicenter (seconds) (*)	Magnitude
Northridge	January 17, 1994	14	7	6.7
Big Bear	June 28, 1992	---	---	6.6
Joshua Tree	April 22, 1992	15	5	6.1
Upland	February 28, 1990	---		5.5
Superstition Hills	November 24, 1987	23	15	6.6
Whittier-Narrows	Oct. 1, 1987	6	3	5.9
Palm Springs	July 8, 1986	20	4	5.9
Imperial Valley	October 15, 1979	30	13	6.4
San Fernando	February 9, 1971	16	8	6.7
Borrego Mountain	April 9, 1968	25	6	6.5
Desert Hot Springs	December 4, 1948	---	---	6.0

Table 3.2-1. Selected Historical Earthquakes in Southern California

Earthquake	Date	Length of Fault (Km) (*)	Duration at Epicenter (seconds) (*)	Magnitude
Manix	April 10, 1947	---	---	6.2
San Gorgonio Pass	June 12, 1944	---	---	5.3
Imperial Valley	May 18, 1940	50	15	6.9
Laguna Salada	December 30, 1934	---	---	6.7
Laguna Salada	December 31, 1934	--	---	7.1
Long Beach	March 10, 1933	15	5	6.4
San Bernardino-Loma Linda	July 23, 1923	---	---	6.2
Cerro Prieto	June 23, 1915	---	---	6
Cerro Prieto	November 21, 1915	---	---	7.1
E. San Bernardino Mountains	September 19, 1907	---	---	5.5 - 6
Lytle Creek - San Bernardino Mts.	July 22, 1899	---	---	6.5
Laguna Salada	February 23, 1892	---	---	>7
Fort Tejon	January 9, 1857	360	130	7.8
Cerro Prieto	November 29, 1852	---	---	6.5

(*) Jones, L.M., 1995, Putting Down Roots in Earthquake County, handbook, Southern California Earthquake Center production, 28 p.
 Note: Update of this table added several earthquakes from nearby Baja California events. These should be included in this table.

The Santa Rosa Mountains, which touch the extreme southwest corner of the General Plan Area, form the prominent mountain range west of Coachella and are part of the much larger Peninsular Ranges that extend from San Bernardino, Riverside and Orange Counties to the southern tip of Baja, California. The Santa Rosa Mountains originally formed in an area in what is now northern Mexico and were transported rather passively (i.e., with little deformation) to the north during offset on the San Andreas fault. The Peninsular Ranges form a strong beam of rock having relatively little weak layering, therefore they are still quite intact and resistant to deformation. In contrast, rocks in portions of the Salton Trough are relatively thin and ductile because magma is so close to the surface. This difference in strength is extremely important in terms of the depths and sizes of earthquakes that could be generated in this region. The strong rocks of the Peninsular Ranges can generate fairly powerful earthquakes because large forces are required to break and subsequently move them. The rocks of the Salton Trough are weaker and will break with much less force.

The general process of crustal extension that appears to have formed the original Salton Trough "low" is referred to as detachment faulting, or formation of a regional low-angle normal fault. This detachment fault is exquisitely exposed in the Santa Rosa Mountains and in many other areas along the western Salton Trough region. Within the Santa Rosa Mountains, this fault is termed the "Santa Rosa Mountains detachment fault", which is a portion of the larger Western Salton Trough detachment system. Although surface exposures of the Santa Rosa Mountains detachment fault west of the Planning Area are evident, the actual trace of this fault at depth beneath the Planning Area is not known.

This same extensional type of faulting tilted, or slightly rotated to one side, the Peninsular Ranges so that the highest portion is on the easternmost, tipped portion of the block (such as Santa Rosa Mountains) and the lowest portion is on the westernmost, down-dropped portion of the block (coastal California). Therefore, the Santa Rosa Mountains define the elevated portion of the detachment fault and expose some of the deepest portions of the Peninsular Ranges known (e.g., Deep Canyon).

The Mecca Hills, rising from the valley floor on the eastern border of the Planning Area, are composed of deformed alluvial sediments that originally filled the narrow region between the Pacific and North American Plates. The complex folding and faulting present in these low, badlands-like hills, forms a unique landform which is world-renowned for its geologic exposures. The sediments of the Mecca Hills record a long history of deposition and faulting associated with the Salton Trough tectonic margin.

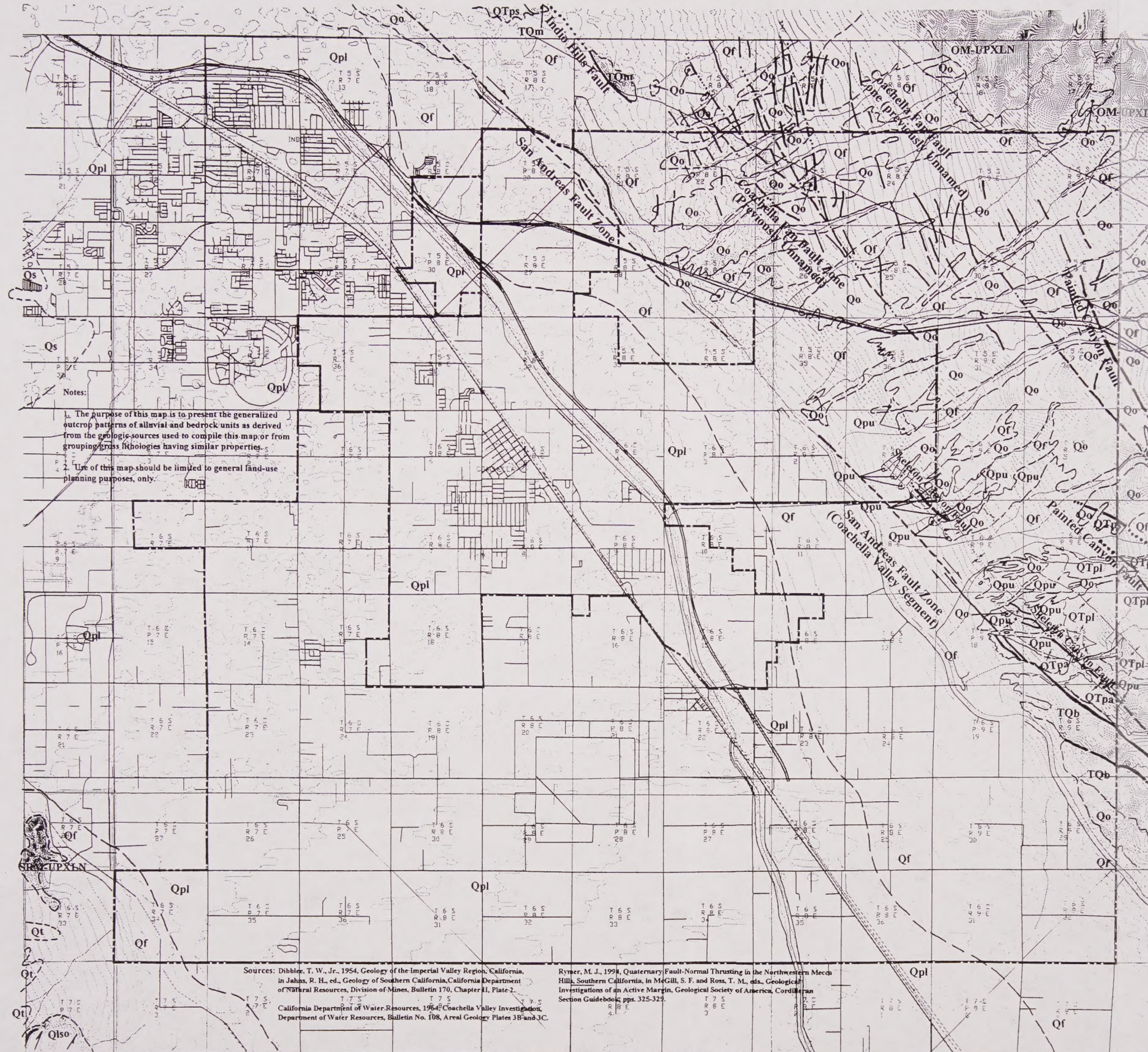
The Coachella Valley is a broad, gently sloping plain comprised of as much as 12,000 feet of sediments that are filling the Salton Trough Structural low. These sediments are derived from the adjacent renovations, Gulf of California, Colorado River and wind blown deposits from the Palm Springs area to the northwest. The southern part of the valley was inundated with a very shallow lake called Lake Cahuilla about 300 years ago. Lake sediments, probably mostly muds, were deposited in this shallow body of water and have since dried and been blown by the wind. The prevailing wind pattern is to the southeast along the length of the valley. The coarsest materials are deposited at the northern end of the Valley (Palm Springs area) where the wind velocity is highest. The downtown area of Coachella is in the transition zone with both sands and clays being deposited within the Planning Area.

In summary, the General Plan Area lies within the Coachella Valley, which is the lowland area lying west of the Indio and Mecca Hills and Orocopia Mountains and east of the Santa Rosa Mountains of the Peninsular Ranges. This valley is actually very young (geologic time scale) and is a direct product of the extensional tectonics related to the mid-Tertiary Salton Sea-Trough detachment fault, the Orocopia detachment system and the more modern San Andreas fault system. Offset along the detachment faults produced the valley which progressively grew as the detachment faults moved. During this offset, sediments were dumped from the topographic highs (mountains) to fill the lows (valleys) and developed geologic units in such areas as the Indio and Mecca Hills, which are now exposed due to movement along the San Andreas fault system. Soils of different ages and compositions have developed on these sedimentary units, and on the younger alluvial units filling the valley floor. These soils form a comparatively thin layer over the underlying geology and pose certain hazards themselves, such as erosion and slope instability. Also, the nature and topographic position of the geology, soils and groundwater contribute to the presence of certain geologic and geotechnical hazards, some of which are mitigable through appropriate engineering studies and practices, others that probably would be best resolved by maintaining the area as open space. The basic geologic units within the planning area are described on Figure 3.2-1, Generalized Geologic Map.

Existing Local Conditions

Geology

Several active, potentially active and non-active faults either transect or are in close proximity to the Planning Area. Active faults, as defined by the California Division of Mines and Geology (CDMG), for inclusion in Alquist-Priolo Earthquake Fault Hazard Zones (APEFHZ) that traverse the Planning Area include the San Andreas, Painted Canyon, Skeleton Canyon, Indio Hills, and Coachella Fan fault zones. Active/Potentially active faults that transect the Planning Area include: 1) the southeasterly fault segments or extensions of the Coachella Fan fault zone and Indio Hills fault, and 2) the northwesterly extensions of the Painted Canyon and Skeleton Canyon fault zones. The above fault zone extensions are considered segments of the San Andreas fault zone and are not presently zoned for Alquist-Priolo Earthquake fault zone or Riverside County Fault zone studies. However, based on currently available literature, they should be considered active, or at a minimum, potentially active. The Santa Rosa Mountain detachment fault underlies the General Plan Area at considerable depth. This fault is considered part of an older fault system and is considered to be inactive. The San Andreas and other fault zones (i.e., San Jacinto, Elisnore) within close proximity to the Planning Area are seismically active and are capable of generating strong ground shaking throughout the Coachella Valley. Maximum





CITY OF COACHELLA

GENERAL PLAN

EIR

EXPLANATION

Geologic Units

Pleistocene-Recent

- Qs - Dune Sand
- Qf - Alluvial Fan and Stream Deposits within Mountain or Hill Areas
- Qpl - Alluvial Plain and Lake Deposits (includes Active Channel Deposits)
- Qt - Older Alluvial Fan and Terrace Deposits
- Qlso - Landslide Deposits, older
- Qo - Ocotillo Conglomerate
- Qpu - Upper Palm Springs Formation

Pliocene-Pleistocene

- QTpa - Arkosic facies of the Palm Springs Formation
- QTpl - Lower Palm Springs Formation
- QTps - Undifferentiated Palm Springs Formation
- TQb - Borrego Formation
- TQm - Mecca Formation

Cretaceous-Past (Miocene?)

- SRM-UPXLN - Upper Plate Crystalline (Granitic) Rocks of the Santa Rosa Mountains Detachment Fault Complex
- OM-UPXLN - Upper Plate Crystalline (Granitic) Rocks of the Orocopia Mountains Detachment Fault Complex

Geologic Symbols

- — — — — Contact, Dashed Where Inferred and Questionable
- - - - - ? Fault, Dashed Where Approximately Located, Dotted Where Concealed or Inferred, Arrows Indicate Direction of Relative Lateral Movement
- ~ ~ ~ ~ ~ Anticline, Dashed Where Approximately Located
- ~ ~ ~ ~ ~ Syncline, Dashed Where Approximately Located
- () Landslide Areas, Arrows Indicate Direction of Movement

Coachella General Plan Area

Figure

Generalized Geologic Map

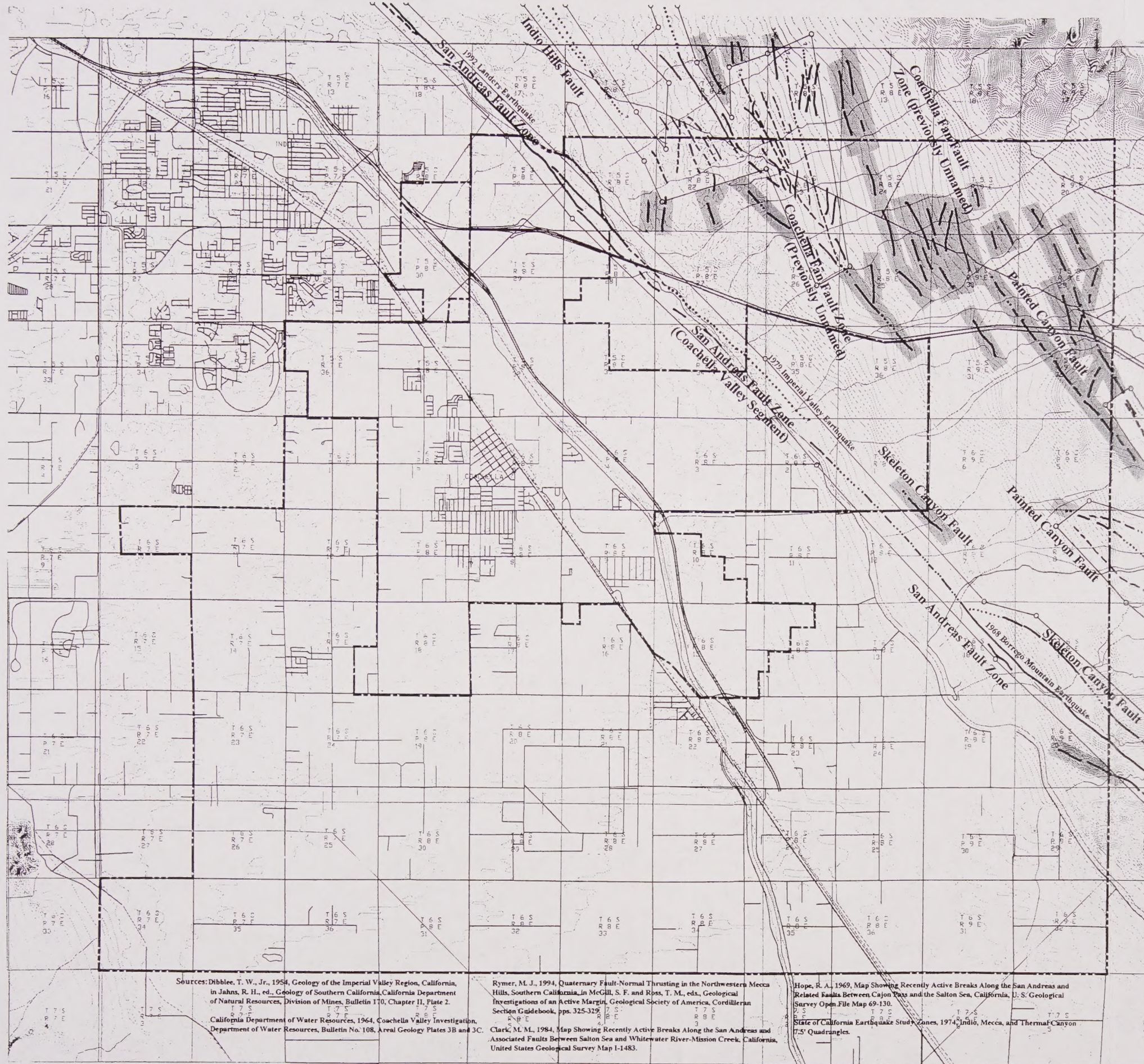
Figure No. 3.2-1

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Fault Explanation Fault Management Symbols

Active-APEFZ
0-11,000 years BP Evidence of historic offset indicated by
(Before Present) year of earthquake-associated event.

Active/Potentially Active
0-750,000 years BP

Fault Map Symbols

Fault, approx. located.

Fault, approx. located-concealed.

Notes:

1. The main objective of this map is to delineate fault hazards recognized by the CDMG-mandated Alquist-Priolo Earthquake Fault Zone Act (APEFZA). Additional faults inferred to be active or potentially active are included on this map because there is published information or scientific opinion by staffs of authoritative agencies that indicate that there is a reason to consider them active. Their inclusion is not intended to prohibit development, but to ensure that proposed projects are supported by geological/seismic investigations that will provide the most accurate obtainable data on the presence or absence of a hazard, and identify necessary mitigation measures.

2. The fault locations on this map are based on published information. Detailed geological investigations, including trenching studies, make it possible to refine the location and activity status of faults. The use of this figure should be limited to general land-use planning purposes only, and should be amended as new data becomes available and are validated.

3. The width of the fault shading does not define a special study limit. Fault shading is used solely to differentiate active faults and non-APEFZ faults from non-active faults. The width of the shaded zone and fault locations should not be used in lieu of site-specific investigations, evaluations and design.

Coachella General Plan Area

Figure

Fault Rupture Hazards

Sources: Dibblee, T. W., Jr., 1954, Geology of the Imperial Valley Region, California, in Johns, R. H., ed., Geology of Southern California, California Department of Natural Resources, Division of Mines, Bulletin 170, Chapter II, Plate 2.
California Department of Water Resources, 1964, Coachella Valley Investigation, Department of Water Resources, Bulletin No. 108, Areal Geology Plates 3B and 3C.

Rymer, M. J., 1994, Quaternary Fault-Normal Thrusting in the Northwestern Mecca Hills, Southern California, in McGill, S. F. and Ross, T. M., eds., Geological Investigations of an Active Margin, Geological Society of America, Cordilleran Section Guidebook, pps. 325-329.
Clark, M. M., 1984, Map Showing Recently Active Breaks Along the San Andreas and Associated Faults Between Salton Sea and Whitewater River-Mission Creek, California, United States Geological Survey Map I-1483.

Hope, R. A., 1969, Map Showing Recently Active Breaks Along the San Andreas and Related Faults Between Cajon Pass and the Salton Sea, California, U. S. Geological Survey Open File Map 69-130.
State of California Earthquake Study Zones, 1974, Indio, Mecca, and Thermal Canyon 7.5' Quadrangles.

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Figure No. 3.2-2

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horizontal ground accelerations from 100 year probable earthquakes on these faults are anticipated to substantially exceed 0.4 g, which is the current maximum Uniform Building Code design value. These faults are described on Figure 3.2-2, Fault Rupture Hazards.

Soil

The principal soil units or soil series within the Coachella General Plan Area are described by the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Riverside County, Coachella Valley Area (September 1980). In general, the development of soil profiles record the surficial weathering of the underlying rock and alluvial units.

The majority of soils found in the Coachella General Plan Area are developed from alluvial fans, valley fill, or lacustrine (lake) basins within the Coachella Valley. The remaining soils were developed over hilly terrain (Indio and Mecca Hills) and on old terraces (base of Santa Rosa Mountains) rimming the valley. The soils on alluvial fans and valley fill range from fine sands in dune areas; to gravely, cobbly, or stony sands adjacent to hillsides; and to sandy loams in the central portion of the Plan Area. Those soils formed within lacustrine basins in the southern portion of the Planning Area are generally loams that can have a clay, silt, and/or sandy component to their character. Finally, those soils situated on hilly terrain and terraces range from sands to loams and can exhibit gravely, cobbly, and/or clayey matrix.

Soils or soil series associations developed on alluvial fans, valley fill, and lacustrine basins within the Coachella General Plan Area include: 1) Carsitas-Myoma-Carrizo, 2) Myoma-Indio-Gilman, 3) Gilman-Coachella-Indio, and 4) Salton-Indio-Gilman-Imperial associations. Soils or soil series associations developed on alluvial fans, old terraces and hilly terrain rimming the Coachella General Plan Area include: 1) Chuckwalla-Badlands, and 2) the Badlands-Carsitas associations. A brief, summary description of these soil types can be found in Appendix B.

Hydrogeology

Both shallow or semi-perched and deep ground water aquifers occur in the Planning Area. The lower or deep water aquifer of the Thermal Subarea of the Coachella Valley Groundwater Basin contains significant groundwater resources within the Planning Area. Historical shallow groundwater levels have been generally less than 10 feet below the ground surface in a majority of the Planning Area. For more information regarding hydrology, see Section 3.3, Hydrology.

Principal Geotechnical Hazards

Seismic and geotechnical hazards include ground rupture, strong ground shaking, liquefaction, shallow ground water, localized earthquake-induced flooding along the All American Canal, landsliding, water-induced ground collapse, subsidence, expansive soils, wind blown soils and erodibility. A summary Planning Area checklist that presents the relative degree of concern for each of these geotechnical and seismic hazards compared to other areas of southern California is depicted in Table 3.2-2.

Soil Erosion

The potential for natural erosional type hazards is high in areas with a combination of the following conditions: 1) moderately steep to steep slopes (>15%), 2) loose to unconsolidated soils and sediments, 3) little or no vegetation cover, and 4) uncontrolled surface water runoff. Changes in any of the above conditions can increase erosion potential, as well as cause surface rilling. Additionally, an increase in erosion can increase downstream sediment loads.

Table 3.2-2
Summary Checklist of Geotechnical and Seismic Hazards *

		RELATIVE DEGREE OF CONCERN				COMMENTS
CATEGORY	POTENTIAL HAZARD/CONCERN	NONE TO SLIGHT	LOW	MODERATE	HIGH	
Seismic Hazards	* Fault Ground Rupture/Fissures * Ground Shaking and Acceleration * Liquefaction * Lateral Spreading, Seismic Settlement, Differential Compaction * Tsunamis * Seiches * Flooding (Pipeline, Aqueduct failure) * Landslides, Rockfall, Unstable Cut and Fill	* *	*	* * * * *	* * * * *	
Slope and Foundation Stability, Land Subsidence, Earthworks Construction	* Landslides, Rockfall, Debris Flow, Soil Creep * Expansive Soils * Collapsible Soils * Settlement Potential, Subsidence * Fissuring (Groundwater withdrawal) * Trench Wall Instability * Rippability		* * *	* * * * *	* * *	Undocumented
Erosion, Sedimentation, Flooding	* Erosion Potential, Wind Blown Sand * Alteration of Runoff * Unprotected drainage * Increased Impervious Surfaces		* *	* * * *	*	
Waste Disposal Problems (On Site Sewage Disposal)	* Change in Groundwater Level * Disposal of Excavated Material * Percolation of Earth Material	*		* *	* *	

* Compared to other areas of southern California, as modified from California Division of Mines and Geology Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports.

Slopes of greater than 15 percent occur throughout the Mecca Hills, isolated areas within the Coachella fan, as well as along the side slopes of the Coachella Valley Storm Channel. Steep slopes combined with certain erodible soil types are recognized as hazardous because construction grading temporarily decreases vegetation coverage and may increase surface water runoff. This condition is especially evident on the slightly elevated Coachella Fan and Mecca Hills in weakly to moderately consolidated alluvial sediments easterly of the Coachella Canal. The soils present in these areas, Carsitas/Chuckwalla-Badlands association sandy to sandy clay loam, are characterized as very steep with numerous deep, steep sided channels having rapid runoff and high erosion potential where soil is left bare. Based on soil type, much of the planning area is considered to have a high to very high erosion potential.

Wind Erosion

Soil types recognized by the Soil Conservation Service and Riverside County Planning Department as having a high to very high wind blown erosion hazard, which may indicate potential limitations for construction and development within the Planning Area, are the Coachella, Myoma and Indio sandy loams. These soil types are found on slopes of less than five percent throughout the Planning Area, primarily in southeasterly trending, elongate dunes formed from the predominant Coachella Valley wind direction. Riverside County Seismic-Geologic Maps depict this soil type in the northwest portion of the Planning Area only. The Riverside County Planning Department has also mapped the above soil types as active blowsand areas within the Planning Area.

Slope Instability

Slope instability includes landslides (both natural and man-made), rockfall, mud/debris flows and soil creep. Slope instability and landslide hazards are primarily relevant only to areas of moderate to high topographic relief. Other factors that influence or affect slope instability include: adverse geologic structure or conditions, such as existing bedding, joints, faults, and ancient landslides; inherent zones of weak rock; expansive or unconsolidated soils; high rainfall or groundwater (seepage, irrigation or subsurface effluent disposal), earthquakes, and changes to topography due to erosion or grading. A majority of these conditions occur in the Mecca Hills, Coachella fan or along the Coachella Valley Stormwater Channel, in the eastern part of the General Plan Area.

Subsidence

Subsidence, the sinking or downward settling of the earth's surface, has become apparent in many parts of California over the last 50 years. The principal cause has been the removal of large volumes of subsurface fluids, such as groundwater or petroleum hydrocarbons. Subsidence caused by groundwater withdrawal is documented throughout the southwestern United States in areas such as the San Joaquin, Santa Clara, Temecula, Antelope, Yucaipa and San Jacinto Valleys in California, and the Phoenix and Tucson Basins in Arizona. Despite efforts to recharge aquifers, subsidence often occurs during years of heavy groundwater withdrawal.

Collapsible Soils

Collapsible soils are low density, silty to very fine-grained, predominately granular soils containing very small pore spaces and voids. When saturated, these soils undergo a rearrangement of their grains and a loss of cementation, resulting in substantial and rapid settlement under relatively low loads. A rise in the ground water table or an increase in surface water infiltration, combined with the weight of a building or structure, can initiate rapid settlement and cause the foundations and walls of these facilities to crack. Collapsible soils generally are the result of rapid deposition of sediment near the source that has not absorbed enough moisture to form a compact soil.

Expansive Soils

Expansive soils are those possessing clay particles that react to moisture changes by shrinking (when they dry) or swelling (when they get wet). Expansive soils can also consist of silty to sandy clay and clayey sand. Extent of shrinking and swelling is influenced by environment, such as alternating wet and dry cycles, and by the amount and kind of clay in the soil. This type of physical change in the soils can react unfavorably with building foundations, concrete walkways, swimming pools, roadways, and masonry walls.

Percolation Potential/Effluent Disposal

Impacts to down stream water quality may occur in areas where on-site sewage effluent disposal is necessary for development. Discharge of effluent from leach lines and/or septic tanks may create and initiate or contribute to slope instability in hillside areas. Most soil types within the gently sloped or flatter portions of the Planning Area are of sufficient thickness to preclude effluent from being introduced directly into fractured rock or to the ground surface. Subsurface water added to already shallow groundwater levels through on-site sewage disposal systems could increase concerns with the secondary effects of seismic hazards, such as liquefaction.

Ground Shaking

Ground shaking or strong ground motion is the primary effect of an earthquake. Although much emphasis has been placed on surface or fault rupture, the shaking effects of an earthquake create the most widespread damage and greatest loss of life, sometimes even hundreds of miles from the epicenter. The Uniform Building Code or UBC has greatly improved the reduction of this hazard in California. However, many unreinforced masonry buildings (URM) still exist that were built prior to the enactment of the earthquake-resistant building codes. Such buildings are notoriously vulnerable to earthquake damage, even collapse.

Surface Rupture

Surface rupture is one of the primary effects of an earthquake where displacement occurs along the fault zone and may produce crustal uplift and subsidence. The extent of damage due to surface rupture is thought to occur along active portions of fault zones. However, the effectiveness of determining this earthquake impact varies depending upon the site geology and fault motion. At times, surface rupture does not accompany seismic activity or earthquakes. For example, no surface rupture occurred during the Northridge earthquake on January 17, 1994, which occurred on a blind thrust or detachment type fault.

Liquefaction

The most common type of secondary seismic hazard is liquefaction, including differential settlement, sand boils, lateral spreading, and lurching type failures. Liquefaction often results in the settling or overturning of heavy structures as well as the rising to the surface of buried tanks or other buoyant infrastructure. See Appendix B, for a more detailed description of liquefaction hazards.

Shallow and Semi-Perched Ground Water Conditions

There are two main, water bearing aquifers in the Thermal Subarea of the Whitewater River (Indio) Subbasin including a lower aquifer and an upper aquifer with a shallow semi-perched or perched water table to within several feet or inches of the ground surface. Shallow groundwater is defined as less than or equal to 50 feet below the ground surface. Groundwater conditions are summarized in Section 3.3, Hydrology and in Appendix B. Water is typically being withdrawn from the lower aquifer and utilized for domestic, commercial and agricultural uses, which tends to recharge the semi perched, shallow groundwater table.

Earthquake-Induced Flooding

Earthquake-induced flooding most commonly occurs with dam, levee, pipeline, canal or aqueduct failures, and with seiches and tsunamis. Above ground fluid storage tanks can also present a localized flood hazard from seismic activity. Tsunamis are earthquake-induced ocean waves that generally occur as a result of sea floor displacement from thrust or normal faults and seldom reach heights of 100 feet.

In comparison, seiches are earthquake-induced waves in large, inland bodies of water. There are no dams, large bodies of water, or oceans up slope of the General plan Area. However, the All American Canal, Whitewater River-Coachella Valley Storm Channel and other lined and unlined drainage channels within the CVWD's drainage and stormwater outlet system are located adjacent to or in the vicinity of the Coachella Valley segment of the San Andreas fault.

Earthquake-Induced Slope Instability

Rockfalls and landslides are types of slope instability that can occur as a direct result of earthquake shaking. Landslides and rockfalls can occur in hillside areas during a strong earthquake. Ground shaking can also cause slope failures in areas with over-steepened road cut slopes and building pad cut slopes within loose earth materials. Additionally, landslides during earthquakes are more likely in the wet season, and in areas of high ground water or saturated surficial soils.

Earthquake-Induced Subsidence

During very large earthquakes, it is possible for subsidence or seismically induced settlement to occur in loose granular soils in the flat or gently sloped portions of the Planning Area as a result of intense ground shaking. Differential settlement, a form of seismic induced settlement, can occur along areas where the depth to bedrock varies abruptly, such as along the edges of alluvial basins, west of the Mecca Hills.

Earthquake-Induced Fire Hazards, Hazardous Material Incidences, and Disruptions to Lifeline Systems

The Coachella General Plan Area can have a variety of earthquake-induced fire hazards and other threats. Earthquake-induced fire may occur in both wildland and urban settings. In the proposed Plan Area, the urban environment can be vulnerable to earthquake-induced fires because of increase in potential development and the possibility of reduced fire fighting capability caused by damaged waterlines or the limitations of fire fighting equipment (e.g., high rise buildings).

The Plan Area is also vulnerable to unauthorized releases of hazardous materials, which can be fatal to hundreds of individuals near the release site. The 1987 Whittier Narrows earthquake enlightened many to the special risk of atmospheric releases of hazardous materials when a chlorine gas leak resulted in the threatened evacuation of a large number of residents. Additionally, ground shaking-caused plumbing leaks from underground fuel storage tanks or rupture of landfill liners could release hazardous substances to ground water supplies. These releases could be undetected for several weeks or months after the causative earthquake.

A large earthquake (M7.7-8.3) on the southern San Andreas fault could cause regional disruption of lifeline systems in the Coachella General Plan area. Impacts to freeways, railroads, communications, as well as natural gas, water, power and sewage systems could occur. This, in turn, may create interference with emergency personnel and critical facilities, such as hospitals, schools, essential services and other dependent care facilities. Some critical facilities, especially older buildings, could also be impacted by damage resulting in loss of use.

Thresholds of Significance

Geologic impacts include those caused by seismicity, soil or slope stability, erosion and siltation. Seismic impacts are considered significant if General Plan policy results in the exposure of people or structures to major geologic hazards. Soil or slope stability impacts are considered significant if General plan policy permits development in areas of unsuitable geologic conditions. Erosion and siltation impacts are considered significant if plan policy would create substantial erosion.

Projects Impacts and Mitigation Provided by General Plan Policy

Erosion

Those portions of the Coachella Planning Area that have slopes steeper than 15% are subject to concentrated water run off erosion of both soil and rock. An increase in sedimentation as a result of increased erosion could significantly impact local agriculture, tile drains, stormwater and drainage channels, and the Coachella Valley Storm Channel (Whitewater River). Most surficial soils within the Planning Area are subject to wind erosion from the prevailing north westerly winds. The scouring and pitting action of blow sand can cause severe damage to vehicles and structures. General Plan Policy provides for the development of a blowsand mitigation program that includes native plants wherever possible and takes into consideration impacts on native flora and fauna that require blowsand habitat for survival. Also, General Plan Policy provides for the preparation of erosion control design plans that conform to the City and County guidelines prior to development activities within the Planning Area. General Plan policy provides for the preparation of a comprehensive hillside conservation ordinance which regulates hillside development in order to minimize impacts due to soil erosion. Consequently, because the General Plan includes policies to identify and mitigate erosion hazards, no significant unmitigable impacts are anticipated.

Slope Instability

No landslides over five acres in size have been documented in the literature or aerial photos reviewed for the Planning Area. It is anticipated, however, that a majority of the potential landslides that could occur in the planning area would include soil slumps and rock falls caused by earthquake activity, debris/mud flows caused by rainfall or concentrated runoff, or man and development induced landslides. Most potential slope instability concerns are located within the eastern hillside portion of the Planning Area. Small surficial slides may have adverse consequences on emergency response for hillside areas given the expected ubiquity of road blockages triggered by widespread landsliding. General Plan policy requires the preparation of design plans that provide for slope protection on newly graded slopes. Also, General Plan policy provides for the preparation of a comprehensive hillside conservation ordinance which regulates hillside development in order to minimize impacts due to landslide. General Plan policy requires all grading and land form modifications in the planning area be carried out under guidelines set forth in the Uniform Building Code, and by the City, County or other responsible regulatory agency. General Plan policy requires building setbacks and structural mitigation to provide the most effective strategy of preventing loss of life and property from debris flows and earthquake induced slope failures. General Plan policy provides for the development of a comprehensive hillside safety program involving slope stability incentives/disincentives for private property owners and provisions addressing post-development stability problems. General Plan policy requires two points of vehicular access for emergency response in hillside areas susceptible to geologic hazards. Consequently, because the General Plan includes policies to identify and mitigate slope instability hazards, no significant unmitigable impacts are anticipated.

Subsidence

While subsidence has not been documented as a significant concern in the Coachella area, the current ground water withdrawal practices and geologic conditions are similar to areas of Riverside County experiencing subsidence problems. In the Thermal Subarea Lower Aquifer, the potential for subsidence due to ground water withdrawal should be considered as moderate to high in that portion of the planning area that occurs West of the All American Canal. If ground water extraction is found to be causing subsidence, prudent subsidence management would require cooperation between all agencies and individuals extracting water. General Plan policy states that the City's intent is to cooperate with the Coachella Valley Water District to prevent or mitigate subsidence due to groundwater extraction in the Coachella Valley alluvial basin. General Plan policy requires a geotechnical investigation be performed

by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where large scale subsidence may occur for new construction, multi-story addition and lateral expansion projects. In addition, General Plan policy requires the City to continually review new geologic studies and soils reports as well as any other pertinent information to update and refine the City's understanding of geologic and/or soils hazards within the study area. Consequently, because the General Plan includes policies to identify and mitigate subsidence hazards, no significant unmitigable impacts are anticipated.

Collapsible Soil

Most collapsible soils are associated with arid and semi-arid environments, such as found in the Coachella General Plan Area. Collapsible soils are most commonly associated with eolian (wind) deposited sands and silts, alluvial fan materials rimming the valley, and mudflow sediment deposited at the base of slopes during flash floods. Collapsible soils may fail with a minimal amount of increased overburden. Those alluvial soils found in the central Planning area, as well as soils rimming the valley should be considered to have a moderate to high potential for collapse. General Plan policy provides for the preparation of design plans prior to development activities within the Planning Area that include proper methods to mitigate collapsible soils. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where collapsible soils may occur for new construction, multi-story addition and lateral expansion projects. Furthermore, General Plan policy requires the City to continually review new geologic studies and soils reports as well as any other pertinent information to update and refine the City's understanding of geologic and/or soils hazards within the study area. Consequently, because the General Plan includes policies to identify and mitigate collapsible soils hazards, no significant unmitigable impacts are anticipated.

Expansive Soils

Coachella General Plan Area is subject to potential expansive soil hazards in the vicinity of Thermal Airport and along the Southern Pacific Railroad tracks near the study area's southern border. According to the Soil Conservation Service, the Imperial and Salton soil series are considered to have a low to high expansion potential. These soils generally occur in the southern portion of the General Plan Area. Soils derived from weathering of consolidated sedimentary rocks in the Mecca Hills in and around the San Andreas fault zone are also considered to have a moderate expansion potential. However, due to the sporadic nature of clayey sedimentary bedrock and fault gouge, the Mecca Hills area could not be assigned an expansive soil classification. General Plan policy provides for the preparation of design plans prior to development activities within the Planning Area that include proper methods to mitigate expansive soils. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where expansive soils may occur for new construction, multi-story addition and lateral expansion projects. In addition, General Plan policy requires the City to continually review new geologic studies and soils reports as well as any other pertinent information to update and refine the City's understanding of geologic and/or soils hazards within the study area. Consequently, because the General Plan includes policies to identify and mitigate expansive soils hazards, no significant unmitigable impacts are anticipated.

Percolation Potential/Effluent Disposal

Those hillside sections of the Planning Area where on-site sewage effluent disposal is necessary for development may create impacts to down stream water quality and initiate or contribute to slope instability. Most soil types within the gently sloped or flatter portions of the Planning Area are of sufficient thickness to preclude effluent from being introduced directly into fractured rock or to daylight to the ground surface. Subsurface water added to already shallow groundwater levels through on-site

sewage disposal systems could increase concerns with the secondary effects of seismic hazards, such as liquefaction. Mecca Hills (badlands) soils are considered to have a moderate to high susceptibility to slope instability and groundwater quality impacts from effluent disposal. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where unsuitable percolation characteristics, slope instability, and/or liquefaction hazards may occur for new construction, multi-story addition and lateral expansion projects. General Plan policy requires percolation tests and sewage disposal evaluations in accordance with County Environmental Health standards for onsite wastewater disposal systems. Also, General Plan policy provides for the continued participation in the National Pollution Discharge Elimination System (NPDES) stormwater program ensuring monitoring of surface water quality and use of Best Management Practices to reduce pollutants. Consequently, because the General Plan includes policies to identify and mitigate effluent disposal hazards, no significant unmitigable impacts are anticipated.

Ground Shaking

Based on its past earthquake history, the Coachella Valley segment of the San Andreas fault has a $22 \pm 12\%$ (high) probability of suffering a large earthquake of $M \geq 7$ during the next 3 decades. Therefore, strong ground shaking from earthquakes that exceed the current UBC design value of 0.4 g should be anticipated within the Planning Area. The following General Plan policies address these issues and no significant unmitigable impacts are anticipated. General Plan policy requires the City to continually monitor and amend its zoning code, building code, and engineering design standards to incorporate the latest Uniform Building Code and Safety Code seismic standards as well as the most current seismic design standards and hazard reduction measures. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where strong ground motion may occur for new construction, multi-story addition and lateral expansion projects. Furthermore, General Plan policy regulates development within Alquist-Priolo and other active/potentially active fault zones, requiring setbacks of at least 50 feet from each side of a mapped active fault or fault zone unless otherwise determined by a certified engineering or registered geologist as per suggested California Division of Mines and Geology criteria. General Plan policy requires consultation with the Division of Mines and Geology or County Geologist to determine seismic hazards in areas where active/potentially active faults have not been mapped. General Plan policy provides for the continual review of new seismic studies to update and refine the City's understanding of geologic hazards within the study area.

Surface Rupture

Several APEFZA defined active and active/potentially active faults occur in the northeastern portion of the General Plan Area. Active faults defined for the Coachella General Plan Area are those with evidence of ground rupture within 10,000 year old or less sediments. Active faults include the San Andreas, Painted Canyon, Skeleton Canyon, Indio Hills, and Coachella Fan fault zones. Active/Potentially active faults that transect the Plan Area include: 1) the southeasterly fault segments or extensions of the Coachella Fan fault zone and Indio Hills fault, and 2) the northwesterly extensions of the Painted Canyon and Skeleton Canyon fault zones. The above fault zone extensions are considered segments of the San Andreas fault zone and are not presently zoned for Alquist-Priolo earthquake fault zone or Riverside County Fault Zone studies. However, based on current studies, they should be considered active, or at a minimum, potentially active. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where active/potentially active faulting may occur for new construction, multi-story addition and lateral expansion projects. General Plan policy requires the City to consult with the Division of Mines and Geology and County Geologist if there are issues or questions concerning fault alignment. The City shall require evaluation and, if necessary, site specific investigation for development proposed within 500 feet of active/potentially active faults to ensure protection of

human life and property. In addition, General Plan policy regulates development within Alquist-Priolo, Riverside County Fault Zones and other active/potentially active fault zones, requiring setbacks of at least 50 feet from each side of a mapped active fault or fault zone unless otherwise determined by investigations performed by a certified engineering geologist. Consequently, because the General Plan includes policies to identify and mitigate surface rupture hazards, no significant unmitigable impacts are anticipated.

Liquefaction

Based on anticipated seismicity, the presence of alluvial sediment and shallow or semi-perched groundwater to within 50 feet of the ground surface, there is a high generalized liquefaction potential within a majority of the Planning Area. Liquefaction hazards include differential settlement, sand boils, lateral spreading, and lurching type ground failure. General Plan policy requires the City to assess the potential impacts of liquefaction on critical facilities and support precautionary measures to address high ground water conditions. General Plan policy requires areas identified as having significant liquefaction potential (including differential compaction, lateral spreading, etc.) to undergo a geotechnical study performed by both a professional soils/geotechnical engineer and a certified engineering geologist prior to development. Consequently, because the General Plan includes policies to identify and mitigate liquefaction hazards, no significant unmitigable impacts are anticipated.

Earthquake-Induced Flooding

There are no dams, large bodies of water, or oceans up slope of the General plan Area. Therefore, the potential for flooding due to tsunamis or seiches is considered to be remote. However, the All American Canal, Whitewater River-Coachella Valley Storm Channel and other lined and unlined drainage channels within the CVWD's drainage and stormwater outlet system are located adjacent to or in the vicinity of the Coachella Valley segment of the San Andreas fault. Intense ground shaking or surface rupture from faulting in the vicinity of the above improvements could create a local flooding hazard. Other structures capable of causing localized flooding upon failure are above ground or ground level storage tanks. These tanks can fail from internal pounding created by the rocking motion of the fluid inside the tank. General Plan policy provides for the preparation of a comprehensive hillside conservation ordinance which regulates hillside development in order to minimize impacts due to floods. General Plan policy restricts development projects in areas that are subject to localized flooding or other high-risk inundation areas (i.e., adjacent to canals) unless properly mitigated to a level of insignificance. General Plan policy encourages the City to coordinate with local water agencies in assessing the potential of seismically induced flooding from the All American Canal and Coachella Valley Stormwater Channel and promote seismically resistant upgrading where necessary. Furthermore, General Plan policy requires the City to coordinate with local water agencies in the siting of water tanks and reservoirs, undergrounding or anchoring where possible, to reduce the effects of flooding in the event of a tank or reservoir failure. General Plan policy requires appropriate flood plain management measures in high-risk inundation areas including flood proofing and securing development projects to minimize potential flood damage. Consequently, because the General Plan includes policies to identify and mitigate earthquake induced flooding hazards, no significant unmitigable impacts are anticipated.

Earthquake-Induced Slope Instability

Rockfalls, landslides and boulder rollout are types of slope instability that can occur as a direct result of earthquake shaking. General Plan policy requires the preparation of design plans that provide for slope protection on newly graded slopes. General Plan policy provides for the preparation of a comprehensive hillside conservation ordinance which regulates hillside development in order to minimize impacts due to landslides. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where existing or potential landslides may occur for new construction, multi-story addition and

lateral expansion projects. General Plan policy requires all grading and land form modifications in the planning area be carried out under guidelines set forth in the Uniform Building Code, and by the City, County or other responsible regulatory agency. General Plan policy requires building setbacks and structural mitigation to provide the most effective strategy of preventing loss of life and property from debris flows and earthquake induced slope failures. General Plan policy provides for the development of a comprehensive hillside safety program involving slope stability incentives/disincentives for private property owners and provisions addressing post-development stability problems. General Plan policy requires two points of vehicular access for emergency response in hillside areas susceptible to geologic hazards. Consequently, because the General Plan includes policies to identify and mitigate earthquake induced slope instability hazards, no significant unmitigable impacts are anticipated.

Earthquake-Induced Subsidence

Existing data is insufficient to identify areas of significant seismically induced settlement potential in the Coachella Valley, although it is anticipated that such areas would be expected to correspond within the areas of shallow ground water, or areas of liquefaction potential. General Plan policy encourages the City to cooperate with the Coachella Valley Water District to prevent or mitigate subsidence due to groundwater extraction in the Coachella Valley alluvial basin. General Plan policy requires a geotechnical investigation be performed by both a professional soils/geotechnical engineer and a certified engineering geologist to address potential areas where large scale subsidence may occur for new construction, multi-story addition and lateral expansion projects. Consequently, because the General Plan includes policies to identify and mitigate earthquake induced subsidence hazards, no significant unmitigable impacts are anticipated.

Earthquake-Induced Fire Hazards, Hazardous Materials Incidences and Disruptions to Lifeline Systems

There is a high to moderate potential for earthquake-induced fires within the Planning Area, primarily from damage to natural gas and electrical transmission lines, and chemical spills. There is also a high to moderate potential for earthquake-induced hazardous materials releases, primarily from pipeline breaks, tank failures, falling containers, and transportation accidents. Furthermore, there is a high to moderate potential for earthquake-induced disruption to major lifeline systems such as airports, freeways, railroads, and communications, natural gas, water, power, and sewage disposal systems which can disrupt or cause a "ripple" effect to critical facilities. Critical facilities that would be impacted by a causative earthquake include police stations, fire stations, hospitals, emergency operations centers, public and private schools, jails, and convalescent homes. The planning area should be prepared to "survive" with little or no outside help for days following a causative event. The following General Plan policies address these issues. General Plan policy requires two points of vehicular access for emergency response in hillside areas susceptible to geologic hazards. General Plan policy discourages land uses in areas subject to geologic hazards for critical use facilities such as hospitals, schools, fire and police stations, utility facilities and communication facilities. General Plan policy requires assessment of potential impacts from geotechnical hazards on major transportation lifelines (i.e., railroads, freeways, airports, etc.) and encourage and support seismic upgrading of these facilities within the City and surrounding communities. General Plan policy ensures that adequate fire protection facilities are utilized by the City and that they are prepared to respond to emergencies produced by a variety of hazards. General Plan policy encourages the City to continue to participate in mutual and automatic aid agreements with local, State, and Federal agencies. General Plan policy encourages the use of fire retardant plants and expand and improve vegetation management efforts in wildland fire hazard areas. General Plan policy requires that a variety of mechanisms be utilized to reduce the threat of fire upon human life and property within the city. General Plan policy provides for the development of an inventory of existing and proposed hazardous material facilities, generators and storage sites to evaluate their safety with regards to ground motion. Also, General Plan policy encourages the City to coordinate with Riverside County to ensure that hazardous wastes are properly collected, transported, and disposed

of to minimize the risk to city residents. General Plan policy requires the City to develop a public awareness/earthquake preparedness program to educate the public about emergency response and preparedness procedures. Consequently, because the General Plan includes policies to identify and mitigate earthquake induced fire, hazardous materials hazards, and disruptions to Lifeline Systems, no significant unmitigable impacts are anticipated.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. There are not anticipated to be any unmitigable significant adverse impacts related to geotechnical concerns as a result of General Plan implementation.

3.3 Surface Hydrology

Existing Conditions

Drainage Basin

The General Plan Study Area lies within the lower end of the Coachella Hydrological Unit which encompasses approximately 1,600 square miles.¹ This area is also referred to as the Whitewater River Basin in which all surface waters ultimately discharge into the Salton Sea. The Whitewater River originates in the San Bernardino Mountains and continues generally southward for approximately 20 miles where it joins with its principal tributary, the San Gorgonio River in the San Gorgonio Pass. Several miles downstream from this point, flows from the Whitewater River typically disappear into the sand west of Palm Springs. The dry watercourse then continues for about 50 miles through the Coachella Valley where it intercepts various other tributaries including Chino Creek, Tahquitz Creek, Palm Canyon Creek and Deep Creek before terminating at the Salton Sea. Only during seasonal storms does the watercourse convey flows and it has been channelized as the Coachella Valley Storm water Channel along the lower branch, including that portion which passes through the City of Coachella.

Flooding History

Damage from floods along the Whitewater River has been recorded as far back as 1916 and historical records indicate that flooding has occurred at least one or more times during every decade since 1825. Although the Coachella Valley averages only about three inches of precipitation per year, drainage problems can occur due to heavy single-event storms in the valley or prolonged precipitation in the surrounding mountains. Flooding generally occurs in the winter months when heavy rains in the surrounding mountains combine with melting of the snowpack resulting in prolonged runoff through the valley. Thunderstorms, which generally occur in the warmer months can result in high intensity precipitation of short duration which can also cause flooding problems.

The largest recorded flood on the Whitewater River occurred in 1938 with a peak discharge of 42,000² cubic feet per second, resulting in estimated damage of \$2,000,000, mainly to roads and bridges, commercial and agricultural properties, and utilities. Given the extent of development and current values, such a flood would cause many times more damage should it occur today. Other floods causing significant damage have occurred in 1965, 1969, and 1976. With channelization of the Whitewater River, regional flood damage to structures outside the channel has been minimal in recent years. Within the Storm water channel itself, however, storm flows cause predictable damage to roads designed as at grade and low water crossings and erosion of unprotected channel banks.

In addition to regional flood issues, the City of Coachella also experiences periodic localized flooding. In particular, minor flooding has occurred approximately once every two years on downtown streets which contribute flows to Shady Lane and Avenue 53. The City has developed engineering plans and is seeking funding to construct facilities which will alleviate this condition. Areas of periodic localized flooding also occur within the unincorporated area south of Coachella but, because of the rural/agricultural character of this area and the fact that flooding serves to complement irrigation that, no master plans to accommodate urbanization have been developed to date.

¹ Coachella Valley Association of Governments Master Environmental Assessment, page 153.

² Coachella Valley Water District: Joseph Cook, Planning Engineer.

Flood Control Agencies

The Coachella Valley Stormwater District was formed in 1915 to help reduce the risk associated with flooding of the Whitewater River. In 1937, this district merged with the Coachella Valley Water District which presently maintains regional flood control facilities in the valley. The CVWD boundaries cover most of the Coachella Valley from the San Geronio Pass to the Salton Sea. CVWD is the primary entity responsible for coordinating and mitigating regional flood issues in the Coachella area. CVWD also is a prominent agency in addressing local drainage issues due to the extensive system of agricultural tile drains which they operate and maintain throughout the rural portions of the Coachella area. Riverside County plays an important role in addressing local drainage issues in unincorporated areas through oversight over County road maintenance functions and development approvals. The City of Coachella Engineering Department is responsible for local drainage issues within the incorporated City of Coachella.

Drainage Facilities

As discussed above, major flooding problems in the Coachella Valley have been largely associated with the Whitewater River Channel. However, channel and levee improvements have been made along most of the Whitewater River channel, limiting areas of a 100-year flood event (Zone A) to within the banks of the channel in most areas. Within the project area, the west side of the channel has been lined with concrete north of Avenue 50, and is designed to handle 82,000 cubic feet per second (cfs)³ or the Standard Project Flood (SPF) which is defined as the largest flood which can occur within a given area. The Standard Project Flood is determined using meteorological data, hydrological data and historical records and is equal to more than twice the amount of flow associated with a 100-year storm event (42,000 cfs).

Other regional flood control improvements include the East Side Dike designed to protect the Coachella branch of the All-American Canal which passes through the northeastern portion of the Study Area. The Bureau of Reclamation provided funds for this project in the 1940s which was constructed with a series of detention basins to protect the canal from mountain runoff. The flow is directed into diversion channels which convey the runoff to the Coachella Valley Storm water Channel.

CVWD also maintains an extensive system of agricultural tile drains throughout the Coachella area consisting of 12 foot long sections of clay, perforated concrete, or perforated plastic pipe butted together in a gravel envelope. The major system of conveyance lines is buried 8-12 feet deep while "onsite" lines which drain private properties and connect to the conveyance system are buried 4-7 feet deep. The tile drains are located along section and quarter section lines within a 50' wide federal easement. The existence of these easements is a significant disclosure issue since they are not picked up by Title Reports and other commonly used disclosure documents.

The tile drain system is designed with two primary functions in mind. First, the tile drains return excess irrigation water to the Coachella Valley Storm Channel and second, they artificially lower Coachella's otherwise high water table. The second function is very important from an agricultural use perspective since the land cannot be farmed if the water table is at the surface. Consequently, maintaining the effectiveness of this system is important to local agriculture. In addition to these agricultural functions, the tile drain system also serves to accept some local surface drainage. Despite the presence of the agricultural tile drain system, areas of periodic localized flooding do occur within the unincorporated area but these storm flows are not detrimental to the agricultural uses in the area.

³ Coachella Valley Water District: Joseph Cook, Planning Engineer.

Presently, most surface drainage within the incorporated City is accommodated via surface flows with no integrated system of drainage structures. Because of this, period flooding is experienced in portions of the downtown which contribute flows to Shady Lane and Avenue 53. Currently, the City of Coachella has developed engineering plans and is seeking funding to construct facilities which will alleviate these local flooding problems. The City also is in the process of developing a drainage master plan which addresses the developed portion of the incorporated City and its environs to the west. In general the plan focusses on surface drainage solutions within streets and rights of way as a means of conveying storm flows. Generally, the 10 year flood will be contained within the street curb while additional flows will be conveyed via a parallel pipe or adjacent greenbelt system.

FEMA Flood Zones

The Federal Emergency Management Agency (FEMA) produces Flood Insurance Rate Maps (FIRM) showing areas subject to 100-year floods. One-hundred-year floods are those floods expected to occur, on the average, once every 100 years, based on historical data. The 100-year flood has a 1/100 or one percent chance of occurring in any given year. Flood insurance rates are based on FEMA's designations of flood zones, and the practice is to avoid or restrict construction within the 100-year flood zones, or to engage in flood proofing techniques such as elevating building pads or by constructing flood walls and levees.

According to the most recent Flood Insurance Rate Map published by FEMA (March 22, 1983), small portions of the Study area remain in Zone AO which is defined as areas of 100-year shallow flooding where depths are between one and three feet. There are also areas within Zone B, which is between the limits of the 100-year flood and the 500-year flood; or subject to 100-year flooding at depths of less than a foot; or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. However, as discussed above, channel improvements to the Coachella Valley Storm Channel which, as stated earlier, is designed to carry the Standard Project Flood, make it likely that no true flood hazard currently exists in these areas. Figure 3.3-1, Drainage Features, shows those portions of the Study Area which had not been removed from the FIRM as of its last update.

According to a letter dated September 21, 1984 from FEMA to the City, the entire city limits as they existed at that time are in Zone C, which is classified as "Areas of Minimal Flooding" however, the most recent Flood Insurance Rate Map dated March 22, 1983 has not been updated to reflect this change in status. The CVWD indicates that the Cities of Indio and Coachella were reclassified to Zone C when channel protection was applied to portions of the Coachella Storm water Channel. In addition, the "limits of study" on this version of the FIRM does not cover unincorporated portions of the study area south of Avenue 58 suggesting that this area may need further evaluation. CVWD does indicate, however, that the Coachella Storm water Channel has ample capacity to contain the 100 year flood in this area.

Surface Water Quality

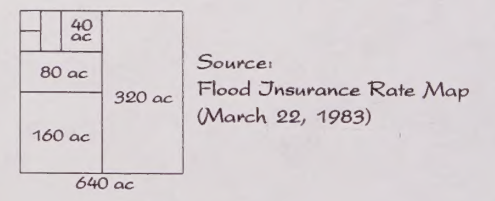
Safe drinking water standards in the United States are regulated by the federal government through the Environmental Protection Agency (EPA). In California, these standards are enforced by the California Department of Health Services (DOHS). Regional Water Quality Control Boards (RWQCB) have been established to protect the quality of ground and surface waters within their respective regions for all beneficial uses. Some beneficial uses include Municipal and Domestic Supply, Agricultural Supply, Fresh Water Replenishment, Ground Water Recharge, Water Contact Recreation, Noncontact Water Recreation, Warm Water Habitat, Cold Water Habitat, Wildlife Habitat, and Preservation of Rare, Endangered or Threatened Species. The regional boards formulate and adopt water quality plans for specific ground and surface water basins and prescribe and enforce requirements on municipal stormwater systems and certain industrial uses. The specific discharge



Drainage Features

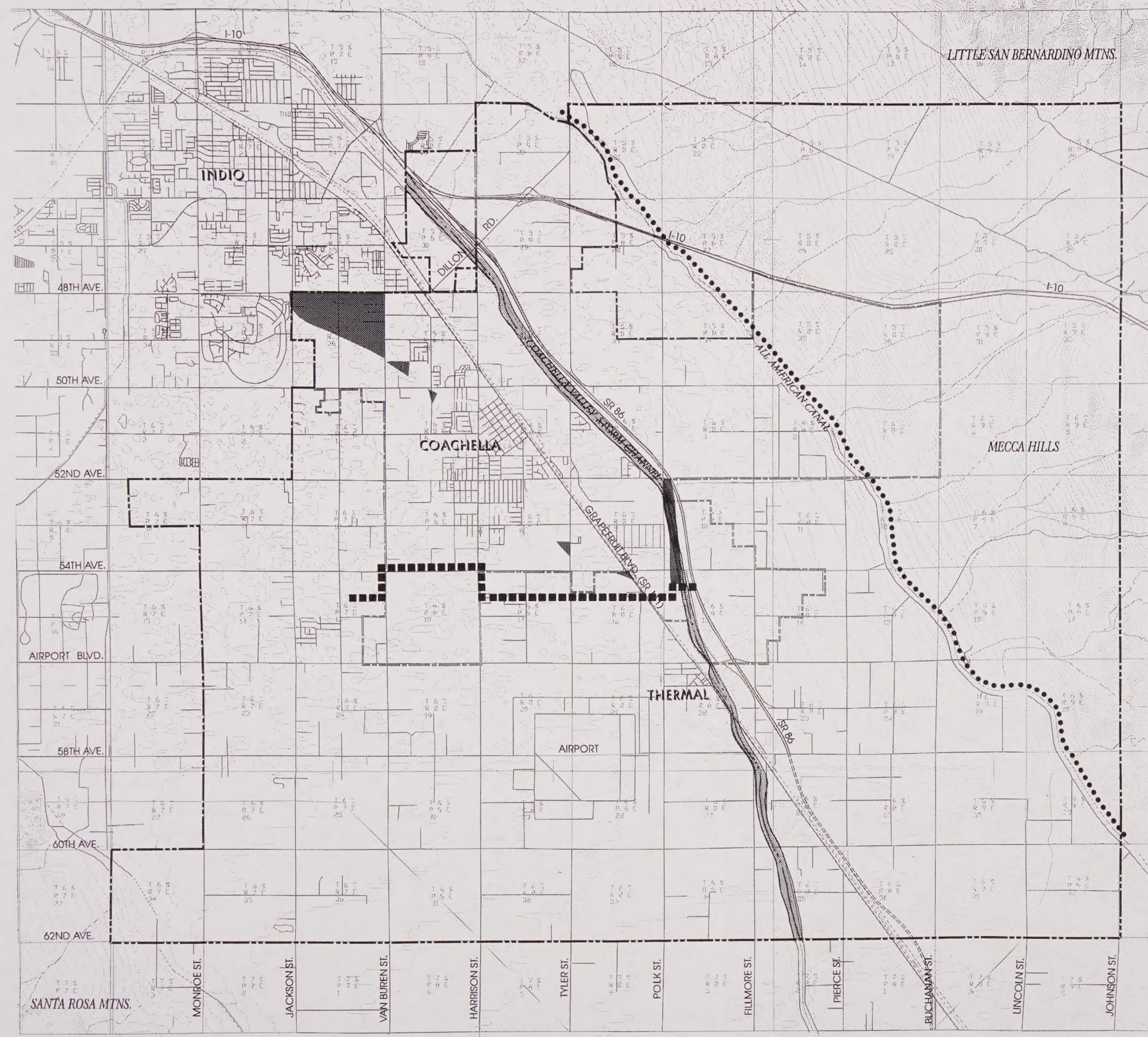
- Flood Hazards**
- Areas with 100 Year Flood Plain designation (FJRM Zone A, AO)
 - Limit of FJRM Study
- Stormwater Facilities**
- Channel
 - Dike

NOTE:
CWD operates an extensive system of tile drains in agricultural areas south and east of the City of Coachella



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Figure No. 3.3-1





requirements to surface waters constitute California's implementation of the National Pollutant Discharge Elimination System (NPDES) program under the Clean Water Act. The Coachella area is within the Colorado River Basin Region (Region No. 7) which adopted its Water Quality Control Plan on November 17, 1993.

The owners and operators of municipal storm sewer systems in the Whitewater River Basin, including the City of Coachella and the Coachella Valley Water District, received approval by the RWQCB in May of 1996 of Board Order 96-015 which includes NPDES Permit No. CAS617002 along with Waste Discharge Requirements governing storm water discharge into the Whitewater River. In applying for the permit, a Storm Water Management Plan was prepared which provides a basis for reducing the discharge of pollutants into municipal storm sewers to the maximum extent practical. The permit establishes Best Management Practices (BMP's) to reduce pollutants, water quality monitoring and sampling standards to evaluate ambient water quality and the effectiveness of BMPs in reducing pollutants.

In addition to the stormwater discharges mentioned above, separate NPDES permits exist for the discharge of waters associated with the collection and treatment of municipal wastewater (i.e., outfalls from wastewater treatment plants) to the following agencies: Valley Sanitary District (NPDES No. CA0104477), Coachella Sanitary District (NPDES No. CA0105031 and CA0104493), and the Coachella Municipal Water District (NPDES No. CA0104973). Similar requirements for pollutant levels and water quality monitoring apply to these facilities.

Outfalls from CVWD's agricultural tile drains are not subject to NPDES permitting but they are monitored by CVWD's Water Resources Department to ensure that no illegal connections or other improper waters are contributed to the system.

Thresholds of Significance

Hydrologic impacts include impacts to water quality, drainage, and flooding. Water quality impacts are considered significant if development substantially degrades water quality or contaminates the public water supply. Drainage impacts are considered significant if development occurs in areas that will flood during storms even if planned drainage systems are built. Flooding impacts are considered significant if the proposed project causes substantial flooding, erosion, or siltation.

Project Impacts and Mitigation Provided by General Plan Policy

Flooding and drainage impacts are considered significant if development occurs in areas that will flood during storms even with improved drainage systems or if a development project would result in substantial flooding, erosion or siltation.

As discussed previously, most of the incorporated City of Coachella is within FEMA Flood Zone C, "Areas of Minimal Flooding". Therefore, development occurring within this area as a result of General Plan implementation would not require flood control improvements associated with the 100-year flood. Local flooding does occur in certain areas of the City, however, and these deficiencies are addressed by General Plan policy which requires the City to complete drainage improvements in the vicinity of Shady Lane and Avenue 53, as well as, to complete and adopt a drainage master plan for the Incorporated City area. The Land use Policy Diagram designates the Coachella Valley Storm water Channel and the All American Canal and associated dike, features which contain the 100 year flood, as Open Space-Conservation (OS) which permits only recreational and other flood compatible uses. Consequently, the General Plan addresses the issue of local and regional flooding within the existing urbanized portions of Coachella and no significant adverse impacts are anticipated.

Also, while CVWD indicates that the Coachella Storm water Channel has been designed with sufficient capacity to protect the entire study area from the 100 year flood, it is recognized that the Flood Insurance Rate Map shows remnant areas of A and AO Flood Zone within the incorporated City and depict unincorporated areas south of Avenue 54 as being outside the "limits of study". General Plan policy requires the City to coordinate with the CVWD and FEMA to remove and/or reclassify as appropriate those portions of the City designated A and AO and to determine flood classifications south of Avenue 54. It should also be noted that the General Plan Land Use Policy Diagram retains most of the area south of Avenue 54 in agriculture should any true flood prone areas be discovered. Consequently, the question of regional 100 year flood designations will be finalized and no significant adverse impacts are anticipated from areas of unknown flooding.

Development facilitated by the General Plan will result in an increase of impervious surfaces which could increase runoff and result in localized flooding problems in some areas. There are General Plan policies that subject individual development projects to review by the City Engineer and CVWD regarding drainage issues and require the provision of all necessary drainage improvements to protect the project itself and downstream properties from project related flood impacts. Consequently, the potential increase in impervious surfaces associated with new development is not anticipated to cause significant adverse drainage impacts.

Development facilitated by the General Plan could also result in increased contribution of drainage through urbanization to CVWD's agricultural tile drain system with associated degradation of system efficiency and potential for damage to agricultural crops by a rising water table. To address this issue, General Plan policies require the City to adopt a Master Drainage Plan for the City which will result in a comprehensive method to handle surface runoff within the City; to coordinate with CVWD in the development of appropriate design standards and criteria for use by new development in directing increased urban runoff from the tile drain system to the City's master planned storm drainage facilities; and to direct all development proposals to CVWD for review. Consequently, the impact of increased development on the agricultural tile drain system is not anticipated to cause significant adverse impacts.

Flooding from seismic events is another potential drainage issue. Within the study area, the All-American Canal at certain locations could be prone to this phenomenon. General Plan policy provides that the City will not approve development projects subject to localized or seismically induced flooding and other high risk inundation areas unless such hazards are mitigated to the satisfaction of the City and other responsible agencies. Consequently, the flooding impacts of seismic events are not anticipated to cause significant adverse impacts.

Surface water quality is an issue of potential concern since wastewater treatment facilities with their associated discharges exist in the vicinity of the study area along with extensive agricultural activities employing the use of pesticides and fertilizers and the potential for increased urban pollutants primarily from street runoff. General Plan policy commits the City to continued participation in the NPDES stormwater program with associated monitoring and best management practices for reducing pollutants. This applies to the municipal storm sewer system as well as the City's wastewater treatment plants including existing, expanded, and new facilities. General Plan policy requires the City to condition development projects for compliance with NPDES construction requirements. Also, General Plan policy states the City's intent to encourage compliance with NPDES requirements by appropriate industries which may occur within the City's jurisdiction. With the provision of these policies, water quality will be monitored and best management practices implemented for municipal storm drainage systems, wastewater treatment plants, construction sites and key industrial uses thus eliminating water quality degradation as a significant impact.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to surface water drainage and water quality are anticipated as a result of General Plan implementation.

3.4 Biotic Resources

The following section on Biotic Resources is compiled from various sources including the California Department of Fish & Game (CDFG) Natural Diversity Data Base (NDDDB), the Natural Heritage Foundation, aerial photo interpretation, and publicly available environmental documents for projects within and adjacent to the Planning Area. Figure 2.4-3, Index to Environmental Documents, provides a list of literature reviewed and their locations in relation to the project area.

Existing Conditions

The Coachella Valley is located within the Sonoran Desert region, a subdivision of the Colorado Desert. It is characterized by low precipitation, low humidity, hot summers, mild winters and seasonal winds. The dominant native vegetation type in the Planning Area is Sonoran Creosote Bush Scrub. Plants in this community are adapted to extreme environmental conditions. Adaptations include modified leaves and stems, high water storage capacity, slow growth, dormant periods, short annual life spans, deep root systems to tap groundwater reserves, losing leaves during dry conditions to conserve moisture, or a combination of these. Plants within this community include creosote bush (*Larrea tridentata*), ocotillo (*Fouquieria splendens*), barrel cactus (*Ferocactus acanthodes*), jumping cholla (*Opuntia fulgida*), smoke tree (*Dalea spinosa*), mesquite (*Prosopis sp.*), and agave (*Agave sp.*). Colorado Saltbush Scrub, another native vegetation type found in the Coachella Valley, occupies low-lying basins and areas of periodic flooding characterized by saline and alkaline soils. Plants within this community include a variety of saltbush species including four-winged saltbush (*Atriplex canescens*), quailbush (*Atriplex lentiformis*), and many-fruit saltbush (*Atriplex polycarpa*).

Within the study area, the majority of the land use is characterized by urban development and agriculture with very little undisturbed native vegetation. Colorado saltbush scrub dominates most of the vacant land situated along the old Whitewater River floodplain with elements of Sonoran Creosote Bush Scrub intermixed throughout the valley floor and becoming dominant on the foothills of the Santa Rosa Mountains and Mecca Hills. Location of native vegetation within the study area is shown on Figure 3.4-1, Native Vegetation Map.

Special interest species were identified by a computer search of the California Department of Fish and Game (CDFG) Natural Diversity Database (NDDDB) (conducted by the CDFG) of the Thermal, Mecca, Valerie, and Indio quadrangles, a literature review, and discussion with professionals in the field knowledgeable of the project area. The United States Fish and Wildlife Service (FWS) keeps a list of candidate species that are known to be threatened but have not been officially listed. The CDFG ranks species as "of special concern" when information exists for that species which indicates that its population is in decline. Other agencies and organizations including the CNPS and National Biological Service also keep lists of rare and threatened species whose conservation status may be of concern.

Sensitive wildlife species that have actually been observed in the project area are shown on Figure 3.4-2, Sensitive Wildlife Species Recorded within the Project Area. A search of the NDDDB revealed the following sensitive, threatened, or endangered plants and animals as being observed or having the potential to occur within the project area:

Prairie falcon (*Falco mexicanus*) is a CDFG species of special concern during nesting season and is considered rare and of restricted range by the NDDDB. This bird is a winter resident in Southern California. It inhabits dry, open, hilly or level terrain, and forages over great distances to find prey. One nesting pair has been recorded in the NDDDB in Painted Canyon, southeast of the project area, and three nesting pairs have been observed on the cliffs of the La Quinta Cove area (La Quinta Redevelopment Project EIR). Although suitable nesting habitat for this species does not occur over most of the project area, foraging activities are probable over agricultural and vacant land.

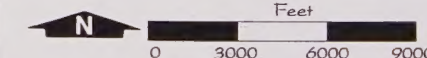
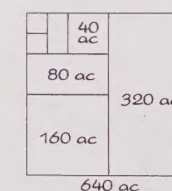


Native Vegetation Map

- Desert Scrub Community (undisturbed)
- Desert Scrub Community (disturbed)
- Mining Operation

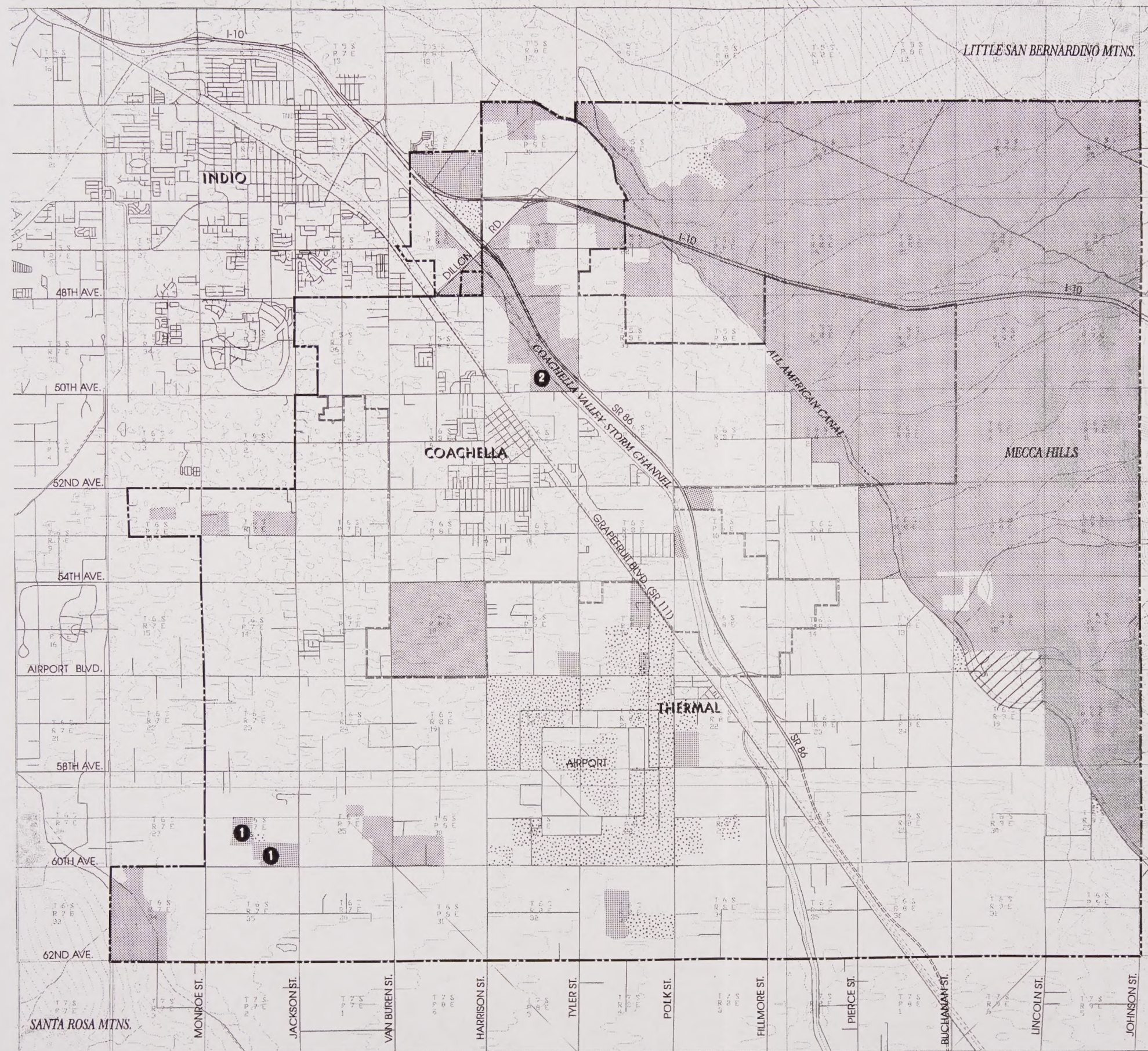
- Mesquite Bosque (Locations approximate)
- Rancho La Quinta Specific Plan FEJR, September 1988
 - Indian Sands Community PUD FEJR, Cabazon Indian Reservation, May 1993

Source:
CVWD Aerial photography (6-1-94),
Coachella GP Update FEJR (7-16-86)



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Figure No. 3.4-1

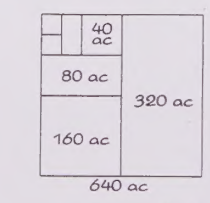




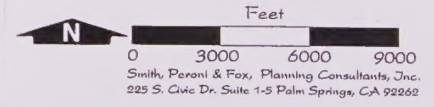
CITY OF COACHELLA GENERAL PLAN EIR

Sensitive Wildlife Species Recorded within the Project Area

- 
Black-tailed gnatcatcher (*Polioptila melanura*)
- 
Burrowing owl (*Speotyto cunicularia*)
- 
Coachella Valley fringe-toed lizard (*Uma inornata*)
- 
Crissal thrasher (*Toxostoma dorsale*)
- 
Ferruginous hawk (*Buteo regalis*)
- 
Golden eagle (*Aquila chrysaetos*)
- 
Loggerhead shrike (*Lanius ludovicianus*)
- 
Northern harrier (*Circus cyaneus*)
- 
Palm Springs ground squirrel (*Spermophilus tereticaudus chlorus*)
- 
Spotted bat (*Euderma maculatum*)
- 
Vermilion flycatcher (*Pyrocephalus rubinus*)
- 
Endangered/threatened animal habitat area (CDCAP)
- 
Special animal area (CDFG NDDB)
- 
Species sighting (CDFG NDDB)
- 
Golden eagle foraging area (CDCAP)
- 
Mecca Hills Wilderness Area

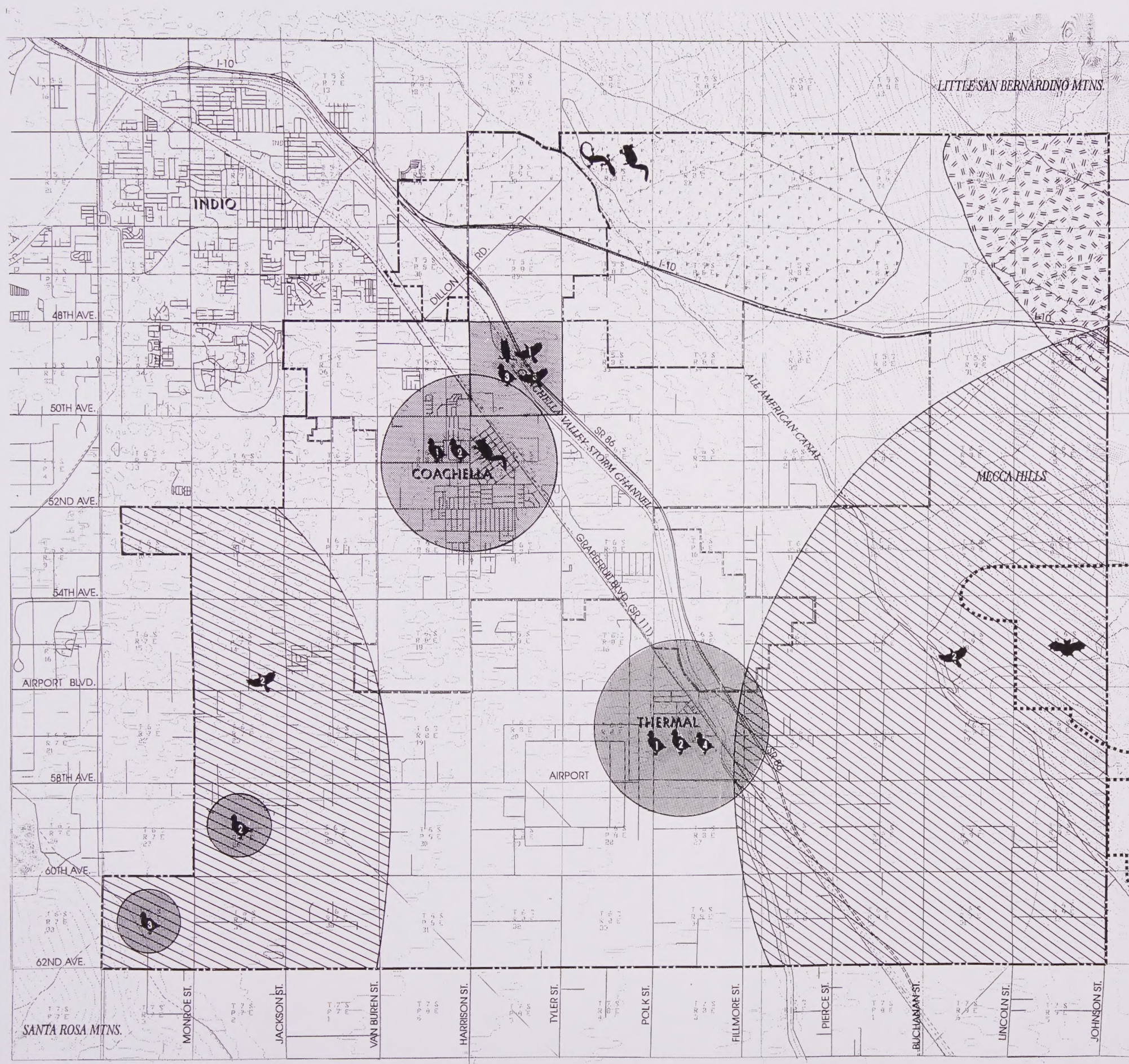


Source: CDFG Natural Diversity Database (1996), California Desert Conservation Area Plan (1980), Misc. EJR's



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Figure No. 3.4-2



Willow flycatcher (*Empidonax traillii*) is considered endangered by the State of California. A migratory bird that inhabits extensive thickets of low, dense willows on edges of wet meadows, ponds or backwaters from 2000 to 8000 foot elevation. This species requires dense willow thickets for nesting and roosting. Low, exposed branches are used for singing or hunting posts. Last known occurrence of this species was in the Mecca area south of the project boundary. This species has a low potential of occurrence in the project area.

Black-tailed gnatcatcher (*Poliophtila melanura*) is a CDFG special animal and is ranked by the NDDDB as endangered. It is a year round resident of wooded desert wash habitats and can also be found in desert scrub habitats, especially in winter. This species nests in desert washes containing mesquite, paloverde (*Cercidium floridum*), ironwood (*Olneya tesota*), and acacia (*Acacia sp.*). It is absent from areas where salt cedar (*Tamarix ramosissima*) has been introduced. Records indicate that this species has been sighted in Thermal and Coachella, within the project area, and in Mecca, south of the project area. This bird has also been recorded in the La Quinta area (La Quinta Redevelopment Project Draft EIR).

Crissal thrasher (*Toxostoma dorsale*) is CDFG species of special concern and is considered rare and of restricted range by the NDDDB. It is a year-round resident of southeastern deserts in desert riparian and desert wash habitats. This species nests in dense vegetation along streams and washes in mesquite, screwbean mesquite (*Prosopis pubescens*), ironwood, catclaw (*Acacia greggii*), acacia, arrow weed (*Pulchea sericea*) and willow (*Salix sp.*). Records indicate this species was observed in Coachella and Thermal, within the project area, and in Mecca, south of the project area. This bird has been recorded in the bajada south of La Quinta (La Quinta Redevelopment Project Draft EIR) as well as in a portion of Section 26, Township 6 south, Range 8 east, in a Mesquite thicket (Rancho La Quinta Specific Plan EIR, 1988).

Le Conte's thrasher (*Toxostoma lecontei*) is a CDFG species of special concern and is considered rare and of restricted range by the NDDDB. It is a year-round resident of open desert washes, desert scrub, alkali desert scrub, and desert succulent shrub habitats. It commonly nests in dense, spiny shrubs or densely branched cactus in desert wash habitat, usually 2 to 8 feet above ground level. Last recorded sighting of this species in the Mecca area, south of the project area. This bird has also been recorded in the bajada south of La Quinta (La Quinta Redevelopment Project Draft EIR).

Vermilion flycatcher (*Pyrocephalus rubinus*) is a CDFG species of special concern and is considered extremely endangered by the NDDDB. A spring migrant that inhabits desert riparian habitats adjacent to watercourses including irrigated fields, irrigation ditches, pastures and other open, mesic areas. It nests in cottonwood (*Populus sp.*), willow, mesquite, and other large desert riparian trees. Last recorded sighting of this species was in the Thermal area, within the project area.

Yellow-breasted chat (*Icteria virens*) is a CDFG species of special concern and is considered rare and of restricted range by the NDDDB. A summer resident of riparian thickets of willow and other dense vegetation near watercourses, it nests in low, dense riparian vegetation consisting of blackberry (*Rubus sp.*) and wild grape (*Vitis sp.*). This bird forages and nests between 0 to 10 feet above ground level. Last recorded sighting of this species was in the Mecca area, south of the project area.

Pallid bat (*Antrozous pallidus*) is a CDFG species of special concern and is considered rare and of restricted range by the NDDDB. It inhabits grasslands, shrublands, woodlands and forests from sea level up through mixed conifer forests. It prefers rocky outcrops, cliffs and crevices with access to open habitats for foraging. This bat is slow flying and extremely maneuverable. It is adapted to feeding on large, hard-shelled prey on the ground or on roosts in trees, shrubs or man made structures. This species is very sensitive to disturbance while roosting. Last reported sighting of this species was in Painted Canyon, southeast of project area.

California mastiff bat (*Eumops perotis californicus*) is CDFG species of special concern. It inhabits steep, narrow, dry, desert canyons, preferring extensive open areas with abundant roosting locations in rock outcrops or buildings. Last reported sighting of this species was in Painted Canyon southeast of project area.

Pocketed free tailed bat (*Nyctinomops femorasaccus*) is a CDFG species of special concern and is considered extremely endangered, rare, and of restricted range by the NDDB. It inhabits a variety of arid regions including, but not limited to, pine-juniper woodlands, desert scrub, palm oasis, desert wash, and desert riparian habitats. It prefers rocky areas with high cliffs or rock outcrops. Last recorded sighting was in Painted Canyon southeast of project area.

Palm Springs ground squirrel (*Spermophilus tereticaudus chlorus*) is a CDFG species of special concern, and is considered extremely endangered by the NDDB. This species is restricted to the Coachella Valley and inhabits desert succulent shrub, desert wash, desert scrub, alkali scrub, and levees. It prefers open, flat, grassy areas in fine-textured, sandy soils. Urbanization, cultivation, and development have reduced the habitat range and population of this species. Records indicate that this species has been observed in Coachella and north of Interstate 10 within the project area, and in Mecca, south of the project area.

Peninsular bighorn sheep (*Ovis canadensis cremnobates*) is a State threatened and federally proposed endangered species; **Nelson's bighorn sheep** (*Ovis canadensis nelsoni*) is a CDFG sensitive animal. Bighorn sheep inhabit steep, rocky, open terrain including bajadas and alluvial fans where escape cover, lambing sites, water and forage are available. The Peninsular subspecies is found west of the Planning Area in the San Jacinto and Santa Rosa Mountains below 4000 feet elevation. Nelson's subspecies is found to the northeast of the project area in the Little San Bernardino Mountains and ranges south into the Chocolate Mountains and north into the White Mountains. Big horn sheep are generally shy and elusive, avoiding human contact, and are not expected to occur in the project area.

Colorado Valley Woodrat (*Neotoma albigula venusta*) A resident of low-lying desert areas in southeastern California, this rodent is associated with beavertail cactus (*Opuntia bigelovii*) and creosote-mesquite habitat. This species historically inhabited the Mecca area but has not been seen in over 20 years, although suitable habitat still exists.

Coachella Valley fringe-toed lizard (*Uma inornata*) is a federally threatened and State endangered animal. It requires habitat with fine, loose, windblown sand and is limited to sand dunes in the Coachella Valley. Records indicate that this species occurs in the Indio Hills northeast of the project area, and along Dillon Road approximately 2.5 miles east of Highway 111. This species historically existed throughout the project area and is considered extant within the project area in undisturbed, wind blown sand habitats.

Desert tortoise (*Gopherus agassizii*) The Mohave population of this species is listed by both State and Federal agencies as threatened and is considered endangered by the NDDB. The Mohave population of tortoises includes those found north and west of the Colorado River in California, southern Nevada, southwestern Utah, and northwestern Arizona. It inhabits almost all desert habitats where soil is friable for burrow and nest construction. It prefers creosote bush habitat with large annual wildflower blooms. Sightings of this tortoise have been recorded in the Chuckwalla Bench and Milpitas wash area to the east of the Planning Area. Five sightings of this species, including one shell, have been observed in the La Quinta area (La Quinta Redevelopment Project EIR) and a small population is known to occur in the Indio Hills, northwest of the Planning Area (Indio General Plan - 2020). The project area lies within the Bureau of Land Management (BLM) Category 3 rating for desert tortoise habitat. Category 3 indicates that the probability of encountering a desert tortoise is low (0 to 20 tortoises per acre), but the area occurs within the historic range of the desert tortoise. Due to current and historic land use, habitat for this species within the project area is marginal.

Cheeseweed owl (*Oliarces clara*) is considered extremely endangered, rare and of restricted range by the NDDB. It inhabits the lower Colorado river drainage and can be found under rocks or in flight over streams. Last reported sighting of this species from Mecca, south of the project area.

Slender woolly-heads (*Nemacaulis denudata* var. *gracilis*) is considered endangered, rare and of restricted range by the NDDB and is considered rare and endangered in California, but more common elsewhere by the California Native Plant Society (CNPS). An annual herb, it prefers sandy dunes at elevations below 400 meters. It blooms from March through May. Last record of this species from the Mecca area, south of the project area. Also was found in Rancho Mirage in an area that is now developed¹.

Other sensitive species not recorded in the NDDB that are considered to be rare or declining and having the potential to occur within the project area based on literature review and the consultants knowledge include:

Swainson's hawk (*Buteo swainsoni*) is considered threatened by the State of California. This raptor breeds in the Central Valley and Great Basin regions from March to April, migrating as far south as pampas of Argentina in the winter. Migrating birds may be observed in the Coachella Valley foraging over open grasslands and agricultural fields. Loss of habitat and decrease of prey species has reduced the abundance of this bird in California.

Ferruginous hawk (*Buteo regalis*) is a CDFG species of special concern. This species inhabits prairies, brushy open space, and badlands. It is a winter resident in southern California and was recorded within the project area during a 1991 biological assessment in Section 32, Township 5 south, Range 8 west for the Indian Sands Community Planned Unit Development, Cabazon Indian Reservation EIR.

Golden eagle (*Aquila chrysaetos*) is a CDFG species of special concern. This species occupies mountain and rangeland habitats in the western United States. It prefers large open spaces with little human activity. Foraging area for this bird occurs within the Planning Area (California Desert Conservation Area Plan, 1980).

Loggerhead shrike (*Lanius ludovicianus*) is a CDFG species of special concern. This bird inhabits arid, open habitat where high "look-out" perches are available. The shrike feeds predominantly on large insects, but will eat small birds or mice when insects are not abundant. This species is in decline, which could be attributable to pesticide use (killing off major food source, intake of pesticides), habitat loss and/or degradation. This species has been observed in the project area on the Cabazon Indian Reservation (Section 32, Township 5 south, Range 8 east) and within the Rancho LaQuinta Specific Plan project area.

Burrowing owl (*Speotyto cunicularia*) is a CDFG species of special concern. This species is a year round resident of open space areas including prairies, sagebrush flats, pinyon-juniper slopes, and deserts with numerous rodent burrows. This bird was observed within the project area during a 1991 biological assessment in Section 32, Township 5 south, Range 8 west for the Indian Sands Community Planned Unit Development, Cabazon Indian Reservation EIR.

Northern harrier (*Circus cyaneus*) is a CDFG species of special concern. This hawk occupies a variety of habitats including marshes, meadows and fields in desert habitats. This species was recorded during a 1991 biological assessment in Section 32, Township 5 south, Range 8 west for the Indian Sands Community Planned Unit Development, Cabazon Indian Reservation EIR.

¹ Andrew Sanders, Curator, U.C. Riverside Herbarium, Personal Communication, March 1996.

Spotted bat (*Euderma maculatum*) is a CDFG species of special concern. One of the rarest North American bats, it inhabits crevices in rocky cliffs and canyons. This species has been recorded in the Mecca Hills Wilderness Area (BLM Wilderness Areas, National Parks and Preserve Maps and Information, June 1995).

Flat-tailed horned lizard (*Phrynosoma mcalli*) is a federal Candidate species for listing and CDFG species of special concern. The flat tailed horned lizard inhabits areas of fine sand and sparse vegetation in desert washes and desert scrub in central Riverside, eastern San Diego and Imperial Counties. It is probably most abundant in areas of creosote bush and is found in desert scrub, cactus succulent shrub, and alkali scrub habitats. This species range has been reduced by human activities including development and recreational use of prime habitat.

California ditaxis (*Ditaxis californica*) is considered rare and endangered in California and elsewhere by CNPS. A perennial shrub that inhabits creosote bush scrub at elevations ranging from 400 to 3000 feet. Infrequently found growing in sandy washes or on canyon floors. Blooms from March to May and again in October through December. This species has been recorded in the California Desert Conservation Area Plan (1988) as occurring in the Painted Canyon area of the Mecca Hills, southeast of the project boundary. It has also been recorded on the western side of the valley, southwest of Indio in the Santa Rosa Mountains.

Of all the species listed, only the Coachella Valley fringe-toed lizard and Desert tortoise require mitigation measures by law. Although many of these species are not legally recognized as threatened or endangered, they are considered to be regionally rare, threatened or endangered by the CNPS and/or NDDB. Protection of these species can be important to the integrity of the Valley's ecosystem, can avoid further complications if listing of any known sensitive species occurs during project development, and can be enforced on a local basis.

Thresholds of Significance

Impacts to Biological Resources are determined by scientific judgement in consideration of the relative importance of the habitat and/or sensitive species affected. If an impact is likely to directly or indirectly cause a measurable change in species composition or abundance above normal variability or is likely to cause a long term change in ecological function within a localized area, it is considered significant.

Measurable changes for less than five to ten years would be considered short-term impacts while those with impacts lasting five to ten years or longer would be considered long-term impacts. Impacts would be locally significant if the size of the affected area is relatively small compared to that of an ecologically equivalent region of impact. Regionally significant impacts occur where the amount of affected area, relative to that available in the region, is large.

Project Impacts and Mitigation Provided by General Plan Policy

Native habitat in the project area is represented by a mixture of Creosote Bush Scrub and Saltbush Scrub, collectively called Sonoran Desert Scrub. Sonoran Desert Scrub is the most common vegetative community in the greater Coachella Valley and removal of this plant community is not considered significant.

Implementation of the General Plan is expected to reduce the amount of habitat available to wildlife, primarily due to conversion of undisturbed native habitat to urban uses. According to land use statistics for the General Plan update (see Section 3.1), approximately 10,000 acres of undisturbed and disturbed native vegetation exists in the Planning Area. Of that, 9,800 acres occur in the Mecca Hills. The remainder exists as fragmented and degraded open space areas between existing agricultural and urban development and isolated patches of native vegetation existing on Indian lands within the Planning Area.

The Mecca Hills area has been designated as open space on BLM administered public lands and as very low residential on private lands. General Plan encourages use of planning techniques such as clustering of development to ensure continuity of habitat and wildlife corridors. By planning open space areas, cumulative impacts to native flora and fauna will be reduced on the local and regional levels. General Plan policies encourage salvage and incorporation of native vegetation into project landscaping, cooperation on the local, state and federal level to develop and implement regional open space and conservation programs to ensure the integrity of native habitat, and require biological assessments for any proposed project site where species or the habitat of species defined as sensitive or special status by the Department of Fish and Game or the U. S. Fish and Wildlife Service may be present.

Agricultural fields can be utilized by sensitive species such as the prairie falcon, ferruginous hawk, and loggerhead shrike for hunting and foraging activities. The General Plan preserves or provides for over 14,000 acres of agricultural lands, approximately 61 percent of the total existing agriculture. General Plan policies require that any substantial conversion of agricultural or vacant lands be evaluated on a site specific basis by a qualified biologist to determine existing habitat value prior to conversion to urban uses. If any sensitive species (i.e., state or federal listed rare, threatened or endangered species) are found, then a mitigation plan must be developed. Therefore, partial loss of existing agriculture is not considered to have a significant impact on biological resources.

Two federally listed species, as well as a number of unprotected sensitive species exist or have the potential to exist within the planning area. To address this issue, General plan policies have been established in order to reduce loss of native habitat and impacts to sensitive species and include the following: General Plan policy provides that native plant species be used in landscaping adjacent to natural areas, General Plan policy encourages the preservation of natural areas within and outside the Planning Area as regional parks or nature preserves. As discussed above, the loss of native habitat in itself is not considered a significant impact. However, habitat loss, fragmentation, and degradation due to increased human activity and proximity all play a role in decreasing or eliminating native plant and wildlife resources. General Plan policies referenced above ensure that habitat for rare, threatened or endangered species is identified and mitigated. Therefore, no significant impacts due to loss of native habitat are expected to occur.

The Coachella Valley Fringe-toed Lizard Habitat Conservation Plan (HCP) has established a fee area to mitigate for loss of habitat for this species as a consequence of development. Payment of the fee effectively mitigates any "take" of this species that might occur due to development activities. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" (16 U.S.C. § 1532(19)). This HCP also benefits other wildlife including the flat-tailed horned lizard, and Palm Springs ground squirrel. The occupiable habitat designated in the HCP includes only a portion of the historic range. Historic CVFTL populations south of the Whitewater River and between Indio and the Salton Sea are considered to be extirpated with virtually no possibility of recolonization and have been excluded from the designated occupiable habitat. Also, the HCP applies only to private land and includes provisions which exempt "disturbed" land that is in legal use at the time of the building permit application from fee payment. Therefore, all land within the project area south of Interstate 10 is excluded from the fee area and that portion of the project area north of the I-10 is included in the fee area and will be required to participate in the HCP program. The General Plan recognizes this program through designation on the Environmental Conservation Policy Diagram and encourages the City to participate in and support the Coachella Valley Multi-Species Habitat Conservation Plan. Therefore, no significant impacts with respect to the Coachella Valley Fringe-toed Lizard are anticipated as a result of General Plan implementation.

As was stated earlier, the project area is located within Category 3 desert tortoise habitat (0 to 20 individuals per acre). The current CDFG strategy for mitigation of the desert tortoise is to acquire superior habitat offsite in regions where preserves can be managed for population viability. Habitat in the Coachella Valley is marginal and not likely to provide for long-term population viability. Therefore,

it is possible to sacrifice existing habitat in favor of alternative locations. Adequate mitigation to reduce adverse effects to a level of insignificance could include payment of mitigation fees to the Coachella Valley Multi-species Habitat Conservation Plan, Chuckwalla Bench Area of Critical Environmental Concern Management Plan, or other Habitat Management Plan that includes protection for the desert tortoise. Acquisition (by the CDFG) of additional habitat of sufficient quality and quantity to meet the ecological requirements of desert tortoise, and to the greatest extent possible, be contiguous or adjacent to existing open spaces, public lands, or reserves is also an appropriate mitigation and compensation measure for habitat that is to be developed. Consultation with appropriate agencies to determine the need for desert tortoise surveys shall be conducted on a site specific basis. All surveys conducted will meet State and Federal requirements. Therefore, no significant impacts with respect to the Desert Tortoise are anticipated as a result of General Plan implementation.

Additional Mitigation Measures and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to biotic resources are anticipated as a result of General Plan implementation.

3.5 Traffic and Circulation

The following section is based on the *City of Coachella General Plan Update Circulation Baseline Technical Study* prepared by Endo Engineering specifically for this Environmental Impact Report (EIR) and is included as Appendix C in the Technical Appendices, bound separately.

Existing Conditions

The City of Coachella arterial circulation system, located within the General Plan Update Planning Area, consists of an incomplete grid system that has developed primarily as section line roadways at one mile intervals in each direction, a situation typical of agricultural areas. The circulation system within the Planning Area is complicated in that State-Route 111 (SR-111), Interstate-10, State-Route 86 Expressway (SR-86), and the Southern Pacific Railroad (SPRR) tracks are aligned diagonally across the grid requiring a modification to the rectangular grid circulation system in their vicinity. Dillon Road, located on the north of the Planning Area, is aligned perpendicular to the railroad tracks.

Roadways

Interstate-10 and SR-111 (a.k.a. Grapefruit Blvd.) provide regional access for the City of Coachella. Interstate-10, a 6-lane divided freeway narrowing to 4 lanes east of the SR-86, passes through the northern portion of the Planning Area and functions as the major transportation facility carrying traffic from western Riverside, San Bernardino and Los Angeles Counties to the west, through the Coachella Valley, into eastern Riverside County and Arizona. The most direct access to the City of Coachella from Interstate-10 is provided by the Dillon Road and Auto Center Drive interchanges.

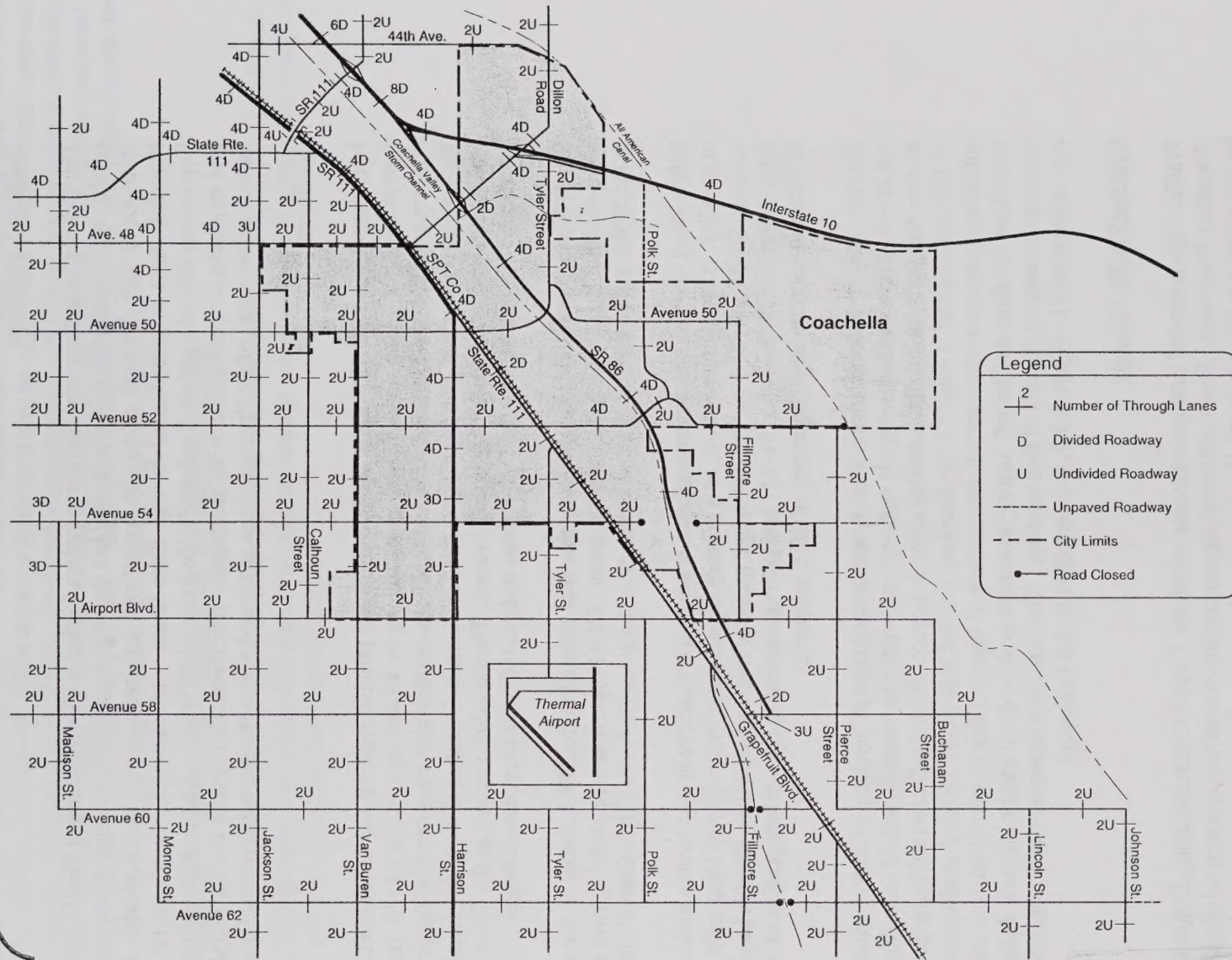
SR-86 is a four-lane divided expressway that runs parallel to the SPRR tracks on the east and provides access to the City of Coachella from the south. SR-111 is a four-lane state highway that runs parallel to the SPRR tracks on the west and serves as primary access to the City's Central Business District.

Dillon Road is a two lane major northeast-southwest oriented roadway located in the northern portion of the City. This roadway serves as a primary access point to the City of Coachella, providing direct access to SR-86 and SR-111. The only major roadway intersecting Dillon Road is Interstate-10. Dillon Road connects to Avenue 48 at SR-111 and provides access to the western portion of the City. Avenue 48 forms the northwestern boundary of the City limits.

The remainder of the local serving street system is composed of two lane collectors which access SR-111 and SR-86. These roadways range in right-of-way widths between 64 and 72 feet. Most of these roads are two-lane, undivided facilities lacking curbs or gutters. Harrison Street (old State Route 86), portions of Dillon Road and Avenue 52 are four-lane divided roadways. Divided roadways typically provide sufficient pavement width for left turn pockets at intersections or mid-block two-way left turn lanes. Undivided facilities require left turning motorists to slow down and/or halt in a through lane, thereby reducing the carrying capacity of that roadway. The existing roadway network which serves the project area is illustrated in Figure 3.5-1, Existing Streets and Highways.

Existing Traffic Controls

Traffic signals control nine intersections within the City of Coachella along Dillon Road, SR-86 and Grapefruit Boulevard. Seven additional signals control intersections located within the Planning Area but not within the City of Coachella. Four-way stops control six intersections in the City of Coachella and five more intersections within the Planning Area. A three-way stop controls one intersection within the Planning Area.



Source: Endo Engineering

Existing Streets and Highways

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Figure No. 3.5-1



Daily planning level traffic signal warrants were checked at each unsignalized key intersection where recent 24-hour traffic count data is available (refer to the signal warrant worksheet in the traffic technical study contained in Appendix D of this document). The results indicate that signalization is not currently warranted at any of the intersections evaluated. The intersection of SR-111 and Tyler Street/Avenue 50 appears to be approaching the daily signal warrants and may warrant signalization in the near future if volumes increase on Tyler Street or Avenue 50.

Posted speed limits within the City of Coachella range from 35 miles per hour along Avenue 52 to 70 miles per hour along Interstate-10. Most of the posted roadways within the City Limits are posted for 45 miles per hour.

Current Traffic Volumes

Peak season weekday traffic volumes were determined with 24-hour machine counters placed at various locations throughout the Planning Area between 1993 and 1995 by CVAG (the Coachella Valley Association of Governments), Caltrans and Riverside County. The count locations are shown in Figure 3.5-2, Current Daily Traffic Volumes, in conjunction with the daily volume and the source of the traffic count data.

The daily traffic volumes shown in Figure 3.5-2 from the Coachella Valley Association of Governments (CVAG) and Riverside County represent 24-hour weekday machine counts that have not been adjusted for seasonal variations or day-of-week variations because the counts were made during the peak season in the Planning Area and were not made on weekends. Caltrans annual average daily traffic (AADT) volumes, by comparison, represent the total volume counted during 365 days divided by 365. In urban areas of over 2,000 population, it has been found that normal weather traffic volumes on weekdays fall within 10% of the average daily traffic (ADT); therefore, no application of adjustment factors for CVAG or Riverside County count data were warranted.¹

Peak Hour Traffic Volumes

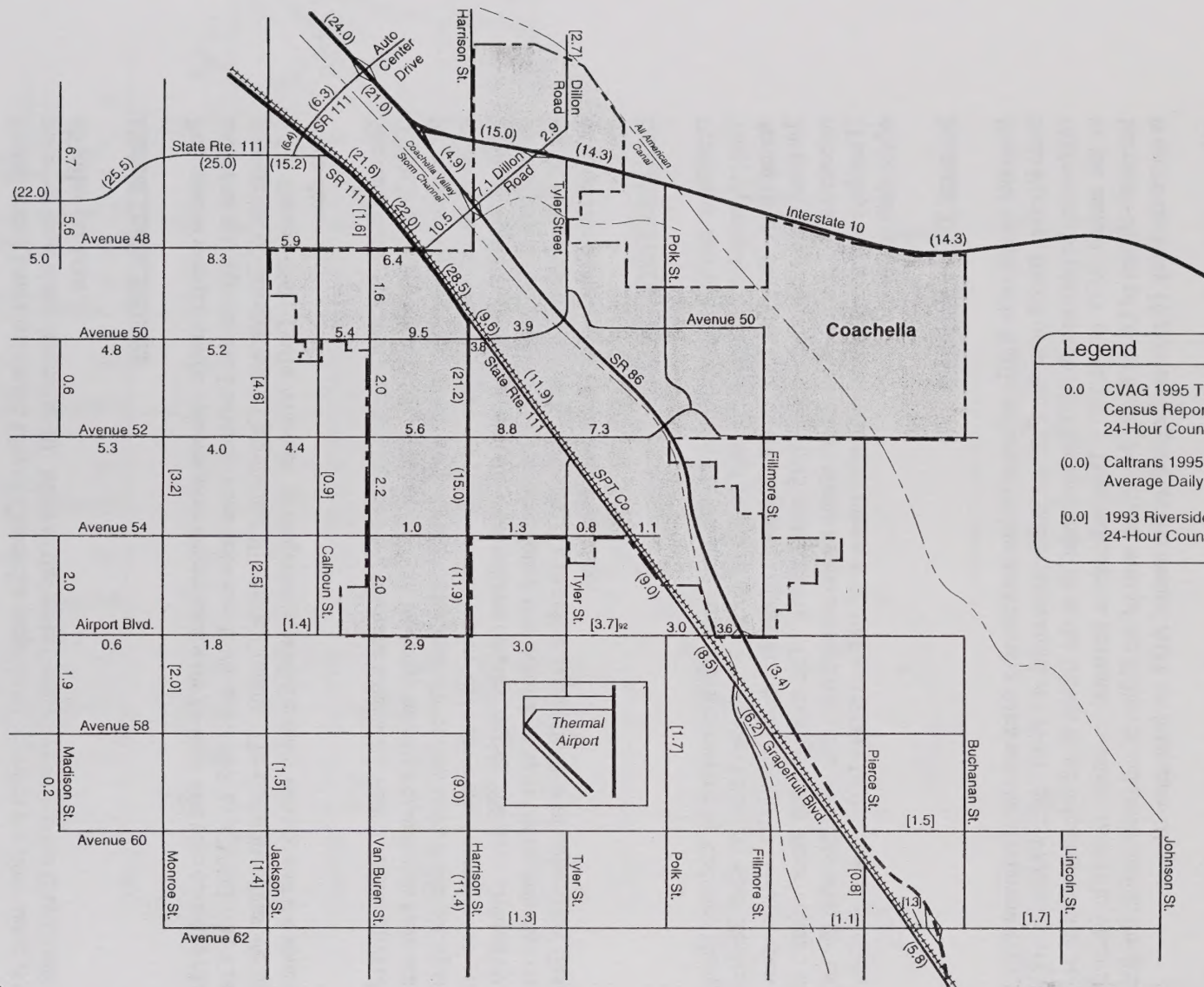
Peak hour traffic volumes within the Planning Area are documented by Caltrans along State Routes. They represented between 8.5% and 10.5% of the daily volumes found on State Routes in the vicinity during 1994. The peak hour on SR-111 south of SR-86 begins at 4:00 PM (based upon a full week of 24-hour count data between 2/1/95 and 2/6/95). The average peak hour volume in this instance represented 8.1 percent of the daily volume for the average day. The weekday with the largest peak hour (Tuesday) had a peak hour volume between 4:00 PM and 5:00 PM that was equivalent to 8.9 percent of the daily volume.

Seasonal Traffic Variations

Seasonal variations in traffic volumes within the Planning Area are also documented by Caltrans along State Routes. Based upon the Caltrans publication entitled *1994 Traffic Volumes on California State Highways*, the peak month ADT on Interstate-10 at the Dillon Road interchange was 16,000 compared to the annual ADT of 14,100. This indicates a seasonal variation in traffic volume of 13.5% on Interstate-10 east of Dillon Road. North and west of the Dillon Road Interchange, the peak month ADT is approximately 16 percent larger than the annual ADT on Interstate-10.

Caltrans 24-hour counts made during the first week of February, May, August and November of 1995 on SR-111 south of SR-86 indicate that the winter volumes (February) were the highest and the summer volumes (August) were the lowest. May and November counts were similar to one another and very

¹ Institute of Transportation Engineers; *Manual of Traffic Engineering Studies*; 4th Edition; 1976; pg. 35.

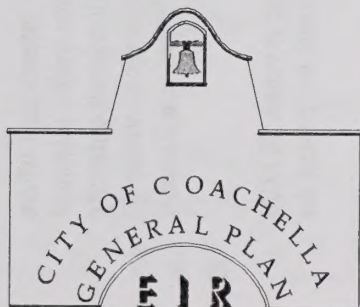


Source: Endo Engineering

Current Daily Traffic Volumes (in Thousands)

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Figure No. 3.5-2



nearly equivalent to the average annual volumes on SR-111. The seasonal variation on SR-111 south of SR-86 included: winter counts that were 7% above the average annual volume; summer counts that were 8% below the annual average; spring counts that were 1% above the annual average; and fall counts that were essentially equal to the annual average.

The 1995 *Traffic Census Report* compiled by CVAG segregates daily counts by season. It indicates that the peak traffic season in the Planning Area is winter. The lowest traffic volumes occur in the summer months. The summer volume represents between 77% and 90% of the winter volumes on the same street during the same year. The fall volumes represent between 90% and 99% of the winter month volumes.

Annual Traffic Growth Rate

Statewide trends, based upon Caltrans traffic count data collected at 22 control stations throughout the state, indicate that state highway travel increased in 1994 by 1.7% compared to 1993. The state highway increase in travel during 1993 compared to 1992 was a more modest 0.5%.

The 1995 *Traffic Census Report* compiled by CVAG includes daily traffic counts since 1988, where available, and permits a more accurate determination of the growth in traffic within the Planning Area. Based upon the available CVAG count data for ten links within the Planning Area, the average traffic growth rate was 7% per year between 1990 and 1995.

Coachella Circulation Element

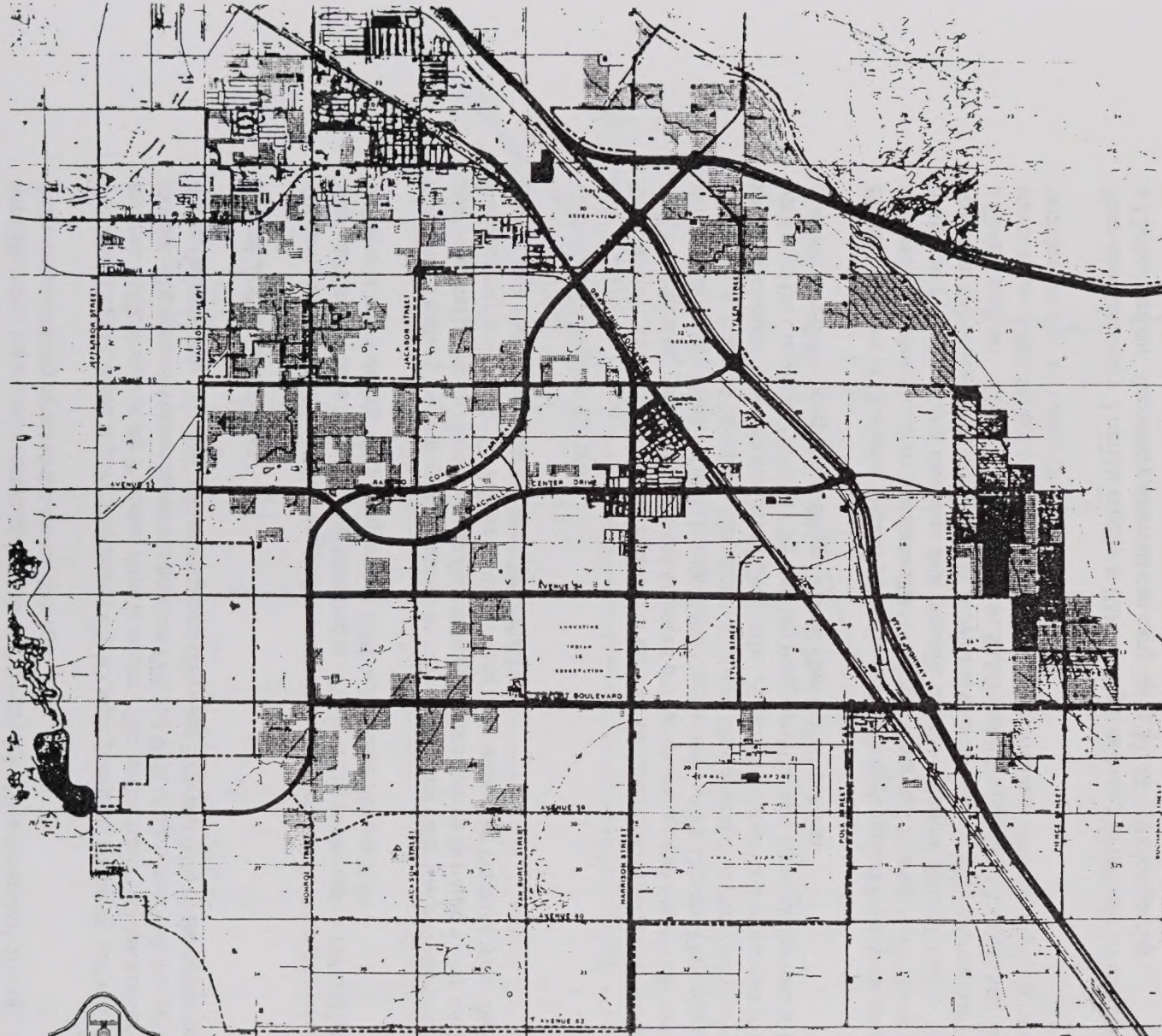
The currently adopted Circulation Element of the City of Coachella General Plan (adopted in January of 1987) details the general location and extent of the circulation system required to serve future traffic demands associated with buildout per the Land Use Element of the General Plan adopted at that time. Figure 3.5-3, Adopted Coachella Circulation Element, illustrates the currently adopted master planned roadway designations within the City of Coachella. Although Figure 3.5-3 represents the latest adopted version of the Circulation Element, City staff has recognized the need for modifications to this circulation plan which will be incorporated in the General Plan Update process.

Figure 3.5-4, City of Coachella, Typical Street Sections, provides typical cross-sections associated with each roadway classification. As shown therein, both Major and Primary Arterials include geometric design and traffic control measures that expedite the movement of through traffic. Major Arterials require a 120-foot right-of-way, and can provide six lanes within a 100-foot roadbed (which includes a 22-foot median). Major Arterials carry up to 50,000 vehicles per day. Primary Arterials provide four travel lanes within 86 feet of pavement (with a 22-foot median). Primary Arterials carry up to 33,500 vehicles per day, 110-foot right-of-way.

Four-lane Secondary Arterials require a 100-foot right-of-way and provide 76 feet curb-to-curb, with a 12-foot median. Secondary Arterials can carry up to 30,000 vehicles per day.

Major and Minor Collector streets are undivided roadways that carry traffic from residential and other local streets to Secondary Arterial or higher classification facilities. Four-lane undivided Major Collectors provide a 64-foot roadbed within an 88-foot right-of-way. Major Collectors can carry up to 25,000 vehicles per day. Two-lane undivided Minor Collectors include 40 to 48 feet of pavement within a 64 to 72-foot right-of-way. Minor Collectors provide full access to abutting properties instead of serving the needs of through traffic and typically carry fewer than 15,000 vehicles per day.

Local streets are 2-lane streets that provide direct access to individual parcels. Local streets typically permit on-street parking on both sides of the street and have a minimum right-of-way width of 56 feet and a curb-to-curb width of 36 feet.



Legend

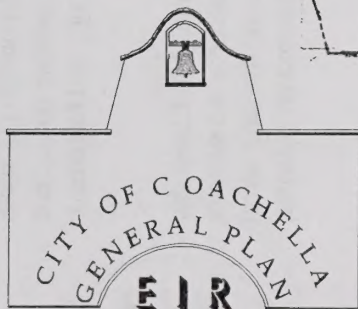
	Freeway	<u>RW</u> Varies
	Major Arterial	120'
	Primary Arterial	110'
	Secondary Thoroughfare	100'
	Collector	64'-88'
	Existing Streets (Not Designated)	Varies
	Interchange	

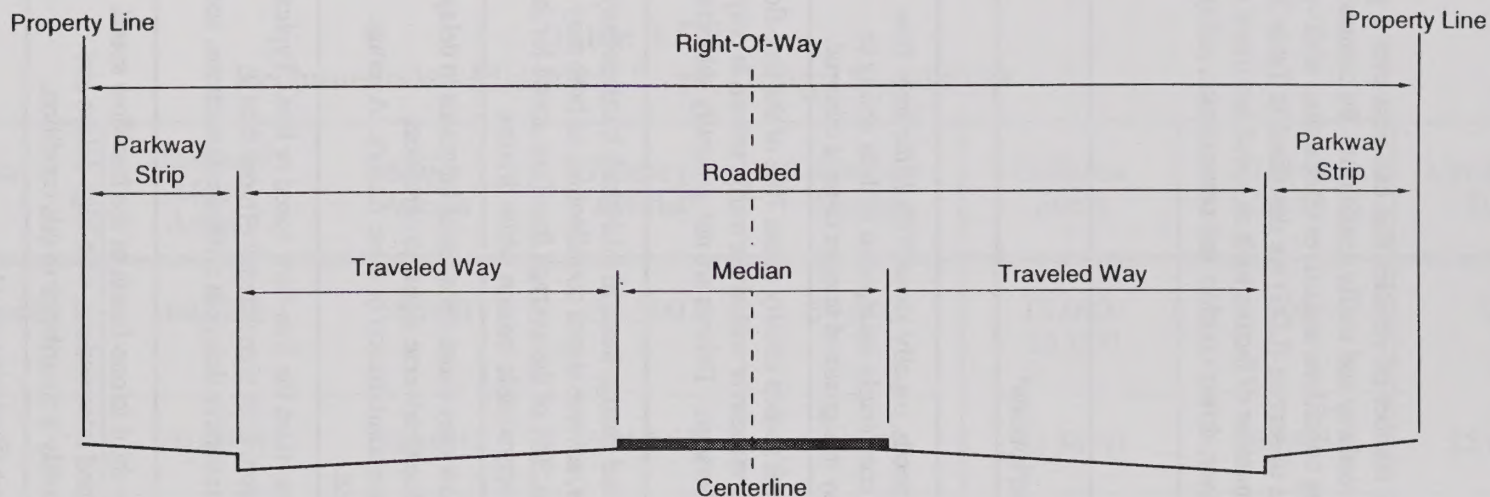
Source: Endo Engineering

Adopted Coachella Circulation Element

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Figure No. 3.5-3





Corridor Classification	Median	Traveled Way	Travel Lanes	Parkway Strip	Roadbed	Right-Of-Way
Enhanced Major Arterial	22'	51'	8	10'	124'	144'
Major Arterial	22'	39'	6	10'	100'	120'
Primary Arterial	22'	32'	4	12'	86'	110'
Secondary Arterial	12'	32'	4	12'	76'	100'
Major Collector	NA	32'	4	12'	64'	88'
Minor Collector	NA	24'	2	12'	48'	72'
Minor Collector	NA	20'	2	12'	40'	64'

Notes: All arterial and major collector sections include a six-foot sidewalk in each parkway strip.
Minor collectors include a five-foot sidewalk in each parkway strip.

Source: Endo Engineering

Not to Scale



City of Coachella Typical Street Sections

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Figure No. 3.5-4

Table 3.5-2, Recommended Minimum Street Design Standards, summarizes recommended minimum street design standards in the City that were developed to assist in the development of a functional, consistent and safe circulation system. Standards are shown by roadway classification for design speed, intersection spacing, access restrictions, stopping sight distance and minimum horizontal radius.

Roadway Capacity Considerations

Roadway capacity has been defined as the maximum number of vehicles that can pass over a given roadway during a given time period under prevailing roadway and traffic conditions. By comparison, levels of service are a relative measure of traffic operating conditions and driver satisfaction, with values ranging from A (free flow) to F (forced flow). Levels of service (LOS) are described in Table 3.5-1, Roadway Level of Service Descriptions. They reflect a number of factors such as speed and travel time, traffic interruptions, vehicle delay, freedom to maneuver, driver comfort and convenience, safety and vehicle operating costs.

**Table 3.5-1
Roadway Level of Service Descriptions^a**

Level of Service	Traffic Flow Characteristics
A	Primarily free flow operations at average travel speeds, usually about 90% of the free-flow speed for the arterial classification. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.
B	Reasonably unimpeded operations at average travel speeds usually about 70% of the free-flow speed for the arterial classification. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.
C	Stable operations; however, ability of maneuver and change lanes in mid-block location may be more restricted than at LOS B, and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50% of the average free-flow speed for the arterial classification. Motorists will experience appreciable tension while driving.
D	Borders on a range in which small increases in flow may cause substantial increases in delay and decreases in arterial speed. LOS D may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these factors. Average travel speeds are about 40% of the free-flow speed.
E	Significant delays and average travel speeds of one-third the free-flow speed or less. Typically caused by some combination of adverse progression, high signal density (more than 2 signalized intersections per mile) high volumes, extensive delays at critical intersections, and inappropriate signal timing.
F	Arterial flow at extremely low speeds (below one-third to one-fourth of the free-flow speed. Intersection congestion is likely at critical signalized intersections, with high delays and extensive queuing. Adverse progression is frequently a contributor to this condition.

a. Source: "Highway Capacity Manual", Special Report 209, Transportation Research Board, 1994; pp. 11-4.

Table 3.5-2
Recommended Minimum Street Design Standards^a

Design Criteria	Enhanced Major Arterial	Major Arterial	Primary Arterial	Secondary Arterial	Collector Street	Local Street	Cul-De-Sac Street
Daily Design Capacity (VPD)	66,500	50,000	33,500	30,000	15,000-25,000	500	300
Design Speed	70 MPH	70 MPH	60 MPH	50 MPH	35 MPH	25 MPH	25 MPH
Intersection Spacing	2640'	2640'	1320'	660'	300'	250'	—
Right-of-Way	144'	120'	110'	100'	64-72'	56'	56' Radius = 50'
Access to Adjoining Property	Intersection Only	Intersection Only	Intersection Only	Avoid Where Possible	Avoid In Some Cases	Acceptable	Acceptable
Curb-to-Curb Width	124' 22' Median	100' 22' Median	86' 22' Median	76' 12' Median	40'-48'	36'	36' Radius = 40'
Stopping Sight Distance (Summit & Sag)	750'	750'	600'	450'	250'	160'	160'
Minimum Horizontal Radius	1800'	1800'	1150'	850'	450'	200'	200'

a. Any deviation from these standards should be based upon a thorough analysis by a qualified traffic engineer and review and approval by City Staff.

An important distinction exists between the concepts of capacity and levels of service. A given lane or roadway may provide a wide range of service levels depending upon traffic volumes and speeds, but it has only one maximum capacity.

The maximum capacity is determined from roadway factors (such as lane widths, lateral clearance, shoulders, surface conditions, alignment and grades) as well as traffic factors (such as vehicle composition (truck and bus mix, distribution by lane, peaking characteristics, traffic control devices, intersections, etc.). It is usually given as the hourly service volume at the upper limit of LOS E because the volume of traffic that can be served under the stop-and-go conditions associated with LOS F is lower than that possible at LOS E; therefore, the upper limit of LOS E corresponds to the maximum flow rate or physical capacity of the facility. For planning purposes, "design" capacities at the upper limit of LOS C or D are often used because they ensure a more acceptable quality of service to facility users and because of the expense required to achieve a better level of service. The City of Coachella has established LOS D as a system performance standard for traffic volumes on the roadway system and as a basic design guideline for roadways.

Table 3.5-3, Daily Roadway Volume Estimates for Each Level of Service, presents daily vehicle volumes at the upper limit of each level of service for freeways, expressways, and each roadway classification within the City of Coachella. The upper limit of LOS D represents the desirable or "design" capacity used for the analysis herein. The upper limit of LOS E represents the absolute maximum capacity under ideal conditions on typical master planned roadways throughout the Planning Area. Ideal conditions assume good weather, good pavement conditions, users familiar with the facility, level terrain, only passenger cars in the traffic stream, no pedestrians or curb parking, and no incidents impeding traffic flow. These capacity values have been applied at the General Plan level as guidelines relating the daily traffic volume to the number of lanes needed mid-block to serve that volume.

It should be kept in mind that the roadway capacity estimates in Table 3.5-3 are "rule-of-thumb" estimates. They are affected by site specific factors such as the number and configuration of intersections, the degree of access control, roadway grades, substandard design geometrics (horizontal and vertical alignment), sight distance, the level of truck and bus traffic, the percentage of turning movements, and the level of pedestrian and bicycle traffic.

The upper limit of LOS D represents the "design" capacity used for the analysis herein. The LOS E maximum capacity values shown in Table 3.5-3 reflect the absolute maximum volume under ideal conditions (assuming improvement to full standards under optimum operating conditions). This level of service is characterized by unstable flows, extremely high volumes, limited operating speeds, and intermittent vehicle queuing. The "design" capacity values shown in Table 3.5-3 have been applied at the General Plan level as guidelines relating the daily traffic volume to the number of lanes needed mid-block to serve that volume. LOS D represents high density but stable flow, with tolerable operating speeds being maintained albeit significantly affected by changes in operating conditions. With LOS D, fluctuations in volume and temporary restrictions to flow may cause substantial drops in operating speeds.

Daily Volume-To-Capacity Analysis

A comparison of daily traffic volumes to the daily "design" capacity gives the proportion of the roadway capacity being utilized by the traffic volumes present. Therefore, a volume-to-capacity (V/C) ratio of 1.0 indicates that the facility is handling the maximum traffic volume that it can accommodate while maintaining the level of service deemed appropriate for design purposes (LOS D). Smaller volume-to-capacity ratios imply better operational characteristics and levels of service. Ratios which exceed 1.0 imply less favorable operating conditions and lower levels of service.

Table 3.5-3
Daily Roadway Volume Estimates for Each Level of Service

Classification	Typical Land Configuration	Volume at the Upper Limit of Each Level of Service (Vehicles/Day)				
		LOS A	LOS B	LOS C	LOS D	LOS E
Freeway ^b	8-Lane Divided	74,000	103,000	132,000	161,000	190,000
Freeway ^b	6-Lane Divided	54,000	75,000	96,000	117,000	138,000
Freeway ^b	4-Lane Divided	34,000	47,000	60,000	73,000	86,000
Expressway ^b	4-Lane Divided	20,000	35,000	50,000	65,000	80,000
Expressway ^c	2-Lane Divided	10,000	17,500	25,000	32,500	40,000
Enhanced Major ^c	8-Lane Divided	26,000	39,500	53,000	66,500	80,000
Major Arterial ^c	6-Lane Divided	20,000	30,000	40,000	50,000	60,000
Primary Arterial ^c	4-Lane Divided	14,000	20,500	27,000	33,500	40,000
Secondary	4-Lane Divided	12,000	18,000	24,000	30,000	36,000
Arterial ^c	4-Lane Undivided	10,000	15,000	20,000	25,000	30,000
Major Collector ^b	2-Lane Undivided	6,000	9,000	12,000	15,000	18,000
Minor Collector ^b						

a. The upper limit of LOS D was assumed as the "design" capacity throughout this study.

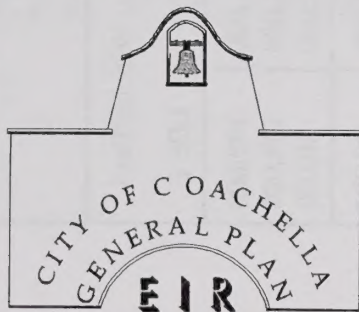
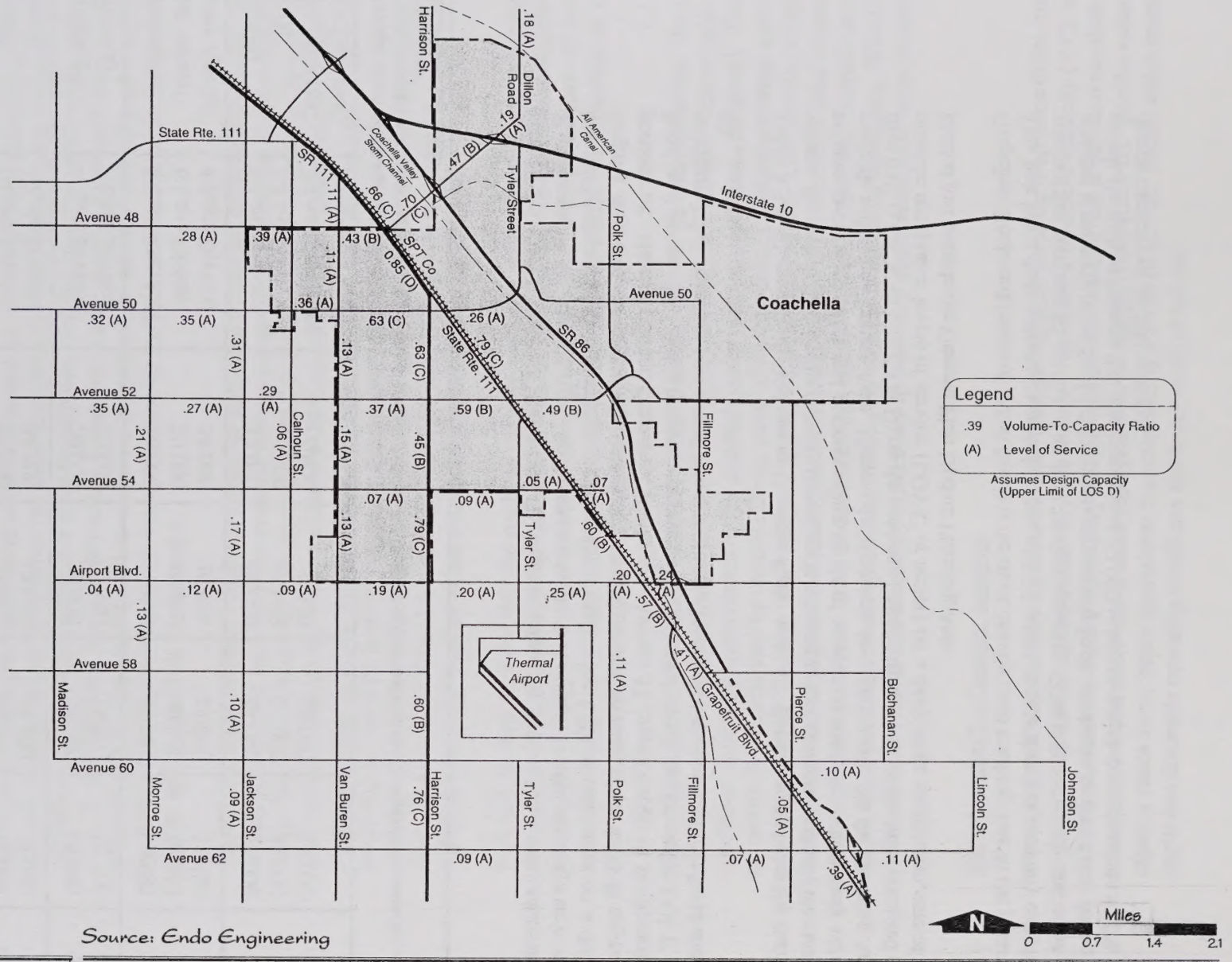
b. Source: Riverside County Road Department, *Information Pamphlet for Riverside County Traffic Circulation and Roadway Improvement Requirements*, Revised 11/24/87.

c. Source: Endo Engineering.

Figure 3.5-5, Current Daily V/C Ratio and LOS, illustrates the daily volume-to-capacity ratios and levels of service within the Planning Area. As shown therein, the vast majority of the roadways serve relatively low traffic demands with motorists experiencing free flowing LOS A conditions on a daily basis. Slightly restricted but reasonably unimpeded conditions can be seen where LOS B appears along portions of: Harrison Street, Grapefruit Boulevard, Avenue 52 (near Grapefruit Boulevard), Dillon Road, and Avenue 48. Stable operation at lower average travel speeds occurs where LOS C is shown on Figure 3.5-5 including portions of Harrison Street, Grapefruit Boulevard, Dillon Road and Avenue 50.

Table 3.5-4, Current Daily Volume to Capacity Ratio and LOS Summary, includes the current daily volume, the current daily design capacity (based upon existing roadway improvements) the current daily volume-to-capacity ratios and corresponding levels of service on roadways where daily volumes are available within the Planning Area. Current daily volume-to-capacity ratios in the Planning Area range from 0.05 (LOS A) to 1.13 (LOS D) on the roadway links analyzed. All of the links analyzed currently provide acceptable levels of service (LOS C or better) on a daily basis except two, one of which is located just outside the General Plan Update Planning Area.

Grapefruit Boulevard (south of Dillon Road) is the most heavily used roadway link in the planning area. This link has a daily volume-to-capacity ratio of 0.85 which means that it is currently carrying traffic volumes that comprise 85 percent of its daily "design" capacity. This link is the only one in the planning area that is currently providing LOS D operation on a daily basis. It should be noted that during the peak month, the daily volume on this link increases to 32,000 vehicles, which corresponds to 95.5% the daily design capacity of 33,500 vehicles.



Current Daily V/C Ratio and LOS

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Figure No. 3.5-5

Table 3.5-4
Current Daily Volume-To-Capacity Ratio
and Level of Service Summary

Roadway Link	Current ADT	Daily Capacity ^a (Veh./Day)	V/C ^b Ratio	Level of Service
Grapefruit Blvd. (SR 111)				
-S/O Dillon Road	28,500	33500	0.85	D
-S/O Harrison St.	9,600	15000	0.64	B
-S/O Avenue 50	11,900	15000	0.79	C
-S/O Avenue 54	9,000	15000	0.60	B
-S/O Airport Blvd.	8,500	15000	0.57	B
-N/O Avenue 58	6,200	15000	0.41	B
Harrison Street				
-N/O Avenue 50	21,300	33500	0.64	C
-S/O Avenue 50	21,200	33500	0.63	C
-S/O Avenue 52	15,000	33500	0.45	B
-S/O Avenue 54	11,900	15000	0.79	C
-S/O Avenue 58	9,000	15000	0.60	B
-S/O Avenue 60	11,400	15000	0.76	C
Avenue 48/Dillon Road				
-W/O Jackson St.	8,300	30000	0.28	A
-E/O Jackson St.	5,900	15000	0.39	A
-E/O Van Buren St.	6,400	15000	0.43	B
-E/O Grapefruit Blvd.	10,500	15000	0.70	C
-W/O Interstate 10	7,100	15000	0.47	B
-E/O Interstate 10	2,900	15000	0.19	A
-N/O 44th Avenue	2,700	15000	0.18	A
Avenue 50				
-W/O Monroe St.	4,800	15000	0.32	A
-W/O Jackson St.	5,200	15000	0.35	A
-W/O Van Buren St.	5,400	15000	0.36	A
-E/O Van Buren St.	9,500	15000	0.63	C
-E/O Grapefruit Blvd.	3,900	15000	0.26	A
Avenue 52				
-W/O Monroe St.	5,300	15000	0.35	A
-W/O Jackson St.	4,000	15000	0.27	A
-E/O Jackson St.	4,400	15000	0.29	A
-W/O Harrison St.	5,600	15000	0.37	A
-E/O Harrison St.	8,800	15000	0.59	B
-E/O Grapefruit Blvd.	7,300	15000	0.49	B
Avenue 54				
-W/O Harrison St.	1,000	15000	0.07	A
-E/O Harrison St.	1,300	15000	0.09	A
-W/O Grapefruit Blvd.	800	15000	0.05	A
-E/O Grapefruit Blvd.	1,100	15000	0.07	A

a. These values represent the current capacity (upper limit of LOS D) in Table 3-3.

b. These values were calculated using the capacity at the upper limit of LOS D.

Table 3.5-4 (Cont.)
Current Daily Volume-To-Capacity Ratio
and Level of Service Summary

Roadway Link	Current ADT	Daily Capacity ^a (Veh./Day)	V/C ^b Ratio	Level of Service
Airport Boulevard				
-W/O Monroe St.	600	15000	0.04	A
-W/O Jackson St.	1,800	15000	0.12	A
-E/O Jackson St.	1,400	15000	0.09	A
-W/O Harrison St.	2,900	15000	0.19	A
-E/O Harrison St.	3,000	15000	0.20	A
-W/O Polk St.	3,700	15000	0.25	A
-W/O Grapefruit Blvd.	3,000	15000	0.20	A
-E/O Grapefruit Blvd.	3,600	15000	0.24	A
Avenue 60				
-E/O Pierce St.	1,500	15000	0.10	A
Avenue 62				
-E/O Harrison St.	1,300	15000	0.09	A
-W/O Pierce St.	1,100	15000	0.07	A
-E/O Grapefruit Blvd.	1,300	15000	0.09	A
-W/O Lincoln St.	1,700	15000	0.11	A
Monroe Street				
-N/O Avenue 54	3,200	15000	0.21	A
-S/O Airport Blvd.	2,000	15000	0.13	A
Jackson Street				
-N/O Avenue 52	4,600	15000	0.31	A
-N/O Airport Blvd.	2,500	15000	0.17	A
-N/O Avenue 60	1,500	15000	0.10	A
-N/O Avenue 62	1,400	15000	0.09	A
Calhoun Street				
-N/O Avenue 54	900	15000	0.06	A
Van Buren Street				
-N/O Avenue 50	1,600	15000	0.11	A
-N/O Avenue 52	2,000	15000	0.13	A
-N/O Avenue 54	2,200	15000	0.15	A
-N/O Airport Blvd.	2,000	15000	0.13	A
Polk Street				
-N/O Avenue 60	1,700	15000	0.11	A
Pierce Street				
-N/O Avenue 62	800	15000	0.05	A

a. These values represent the current capacity (upper limit of LOS D) in Table 3-3.

b. These values were calculated using the capacity at the upper limit of LOS D.

Relevant Circulation Plans

Riverside County Circulation Element

Figure 3.5-6 provides the Riverside County Circulation Plan for the planning area that was adopted on April 26, 1994. A comparison of the roadway classifications shown in Figure 3.5-6 to those in the Coachella Circulation Element adopted in January of 1987 (Figure 3.5-3) indicates that within the current City Limits, the master planned rights-of-way either match or else the City Circulation Plan reserves more right-of-way than the Riverside County Circulation Plan.

However, south of the City Limits, the Riverside County Circulation Plan (almost without exception) reserves larger rights-of-way for roadways than that shown by the City of Coachella Circulation Element. This is the case along Avenue 58, Avenue 60, Monroe Street, Jackson Street, Van Buren Street, Polk Street, Pierce Street, Buchanan Street and Lincoln Street. The Riverside County and Coachella Circulation Plans include identical right-of-way requirements for Harrison Street (south of Airport Boulevard) and Avenue 62 (between Harrison Street and Monroe Street).

The Riverside County Circulation Element also includes the following right-of-way requirements, which are larger than the currently adopted City of Coachella Circulation Element:

- Calhoun Street (north of Avenue 48) with an 88-foot right-of-way;
- Van Buren Street (north of Avenue 52) with a 100-foot right-of-way; and
- Madison Street (between Avenue 52 and Avenue 60) with a 134-foot right-of-way.

Riverside County Scenic Highways Element

The State Scenic Highways Program seeks to identify, protect and enhance State scenic resources with assistance from local, County and State agencies. Although no highways in the planning area are currently included on the *State Scenic Highway System List of Eligible and Officially Designated Routes* (Revised March 31, 1993), Riverside County utilizes the same criteria established in the State Scenic Highways Program for determining eligibility of routes and corridors as scenic highways.²

A corridor study must be completed by the Riverside County Planning Department and approved by the State Director of Transportation, before a route can be designated as an Official County Scenic Highway. Although there are currently no Official County Scenic Highways in the planning area, the Riverside County Scenic Highways Element includes two Eligible County Scenic Highways within the planning area.

Interstate-10 (from the junction with Highway 62 to the Colorado River) is an Eligible County Scenic Highway. It extends through the Coachella Valley, providing a panoramic view of the desert and the encircling mountains as well as agricultural and resort areas. Dillon Road (north of Interstate-10 to Palm Drive) is also an Eligible County Scenic Highway.

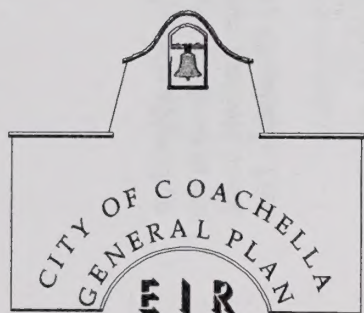
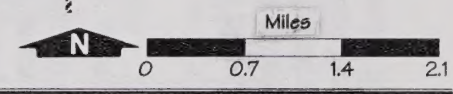
La Quinta Circulation Element

Figure 3.5-7, La Quinta Circulation Plan, provides the La Quinta Circulation Plan for the planning area that was adopted on October 6, 1992. A comparison of the roadway classifications shown in Figure 3.5-7 to those in the Coachella Circulation Element adopted in January of 1987 (Figure 3.5-3) indicates that City of Coachella Circulation Plan reserves more right-of-way than the La Quinta Circulation Plan along Avenue 52 (west of Monroe Street) and along Monroe Street (between Avenue 54 and Avenue 58). The

² County of Riverside; *Comprehensive General Plan*; 4th Edition; Reprinted 1994.



Source: Endo Engineering



Riverside County Circulation Plan

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Figure No. 3.5-6

La Quinta Circulation Element includes Avenue 53 (west of Monroe Street) as a collector street. It also designates Madison Street (between Avenue 50 and Avenue 58) and Avenue 60 (west of Monroe Street) as primary arterials. These two roadways are not shown on the Coachella Circulation Element.

The La Quinta General Plan identifies special roadway image corridors and city gateways which evoke a unique identity and character. Building height limits are established and landscaped setbacks for walls, buildings and parking areas are identified by roadway classification. Special right-of-way width and design treatments are discussed such as wall openings to allow views into projects from image corridors and undergrounding of utilities wherever possible. To prevent visual blight along image corridors, a comprehensive sign ordinance is administered.

The La Quinta Streetscape Image Policy Diagram depicts Avenue 52 and Avenue 50 (west of Madison Street) as secondary image corridors with secondary gateway treatments at Madison Street. Secondary image corridors are streets with raised landscaped medians and landscaped areas within and contiguous to the street right-of-way where the use of lower profile indigenous canopy trees, accentuated with citrus trees shall be emphasized. The use of taller vertical landscape elements like palm trees is de-emphasized and occurs in nodes primarily at street intersections. Secondary gateway treatments rely on the use of landscaping, street lighting and monument signage as the major design elements, rather than special paving, street furniture and hardscape/screen wall arrangements.

Agrarian image corridors are designed to evoke a rural ambiance and provide a strong linkage to the City of La Quinta's agricultural past. Avenue 54 (west of Monroe Street) is shown as an agrarian image corridor with a secondary gateway treatment at Monroe Street. Madison Street (from Avenue 50 to Avenue 58) is also shown as an agrarian image corridor. These corridors are located in rural residential areas and shall incorporate equestrian trails and design themes reminiscent of rural areas (like shaded country lanes without vertical curbs on the outside lane of the roadway).

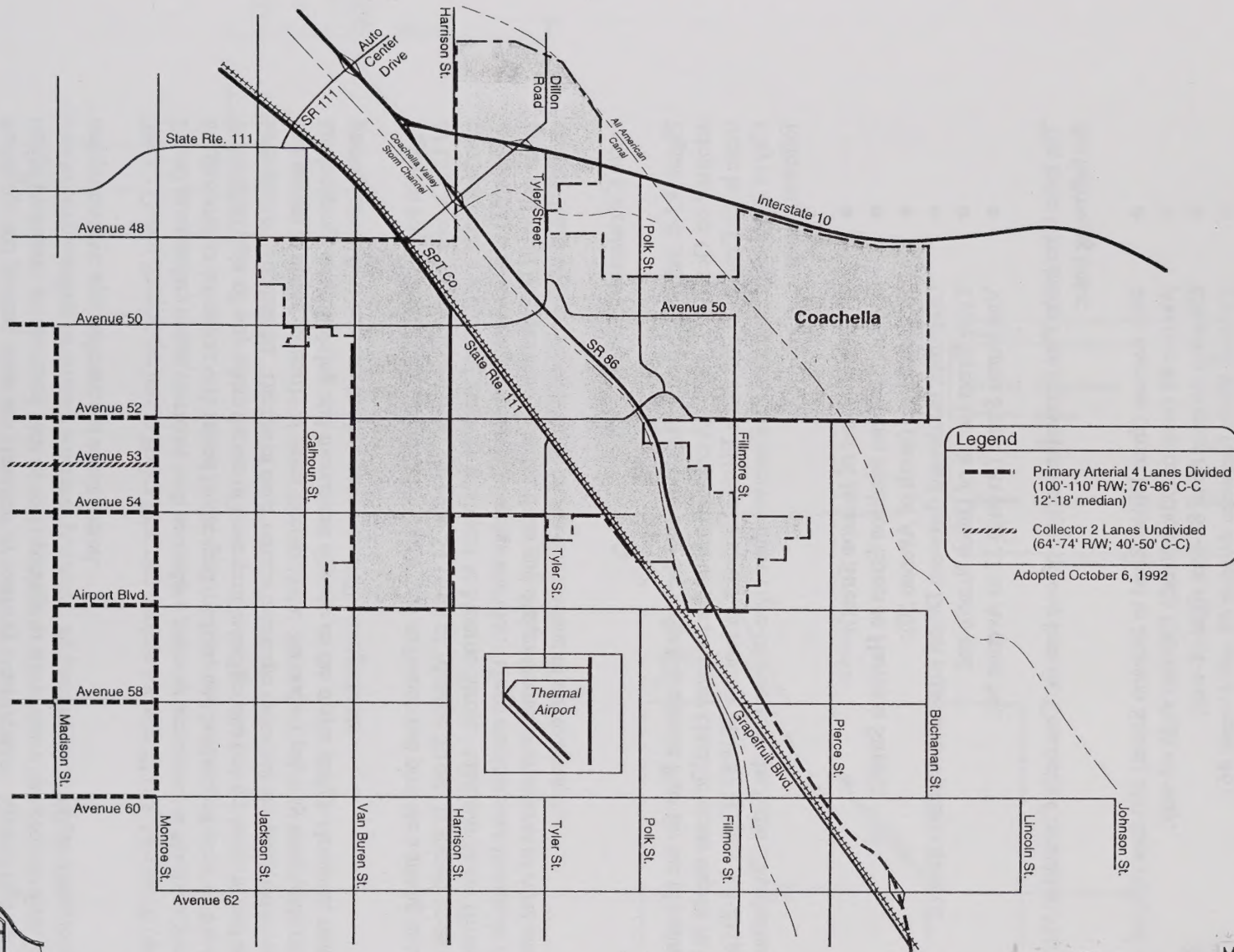
Indio Circulation Element

Figure 3.5-8, Indio Circulation Plan, provides the Indio Circulation Plan for the planning area that was adopted on October 7, 1993. A comparison of the roadway classifications shown in Figure 3.5-8 to those in the Coachella Circulation Element adopted in January of 1987 (Figure 3.5-3) indicates that the City of Coachella Circulation Plan reserves more right-of-way than the Indio Circulation Plan along the following links:

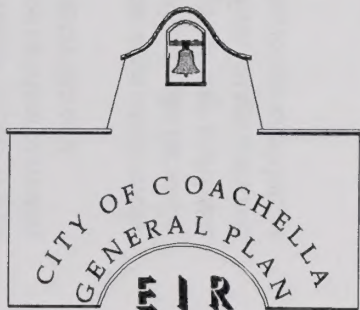
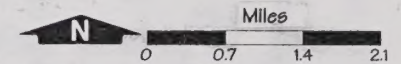
- Avenue 50 (west of Jackson Street);
- Avenue 52 (from Madison Street to Harrison Street);
- Jackson Street (north of Avenue 50);
- Grapefruit Boulevard (between Dillon Road and Harrison Street);
- Tyler Street (south of Dillon Road); and
- Van Buren Street (Avenue 52 to Avenue 54).

The Indio Circulation Plan reserves more right-of-way than the Coachella Circulation Plan along the following links:

- 44th Avenue (from Dillon Road to Jackson Street) 100-foot right-of-way;
- Avenue 48 (west of Dillon Road) 100-foot right-of-way;
- Cabazon Avenue 66 to 88-foot right-of-way;
- Calhoun Street (between Avenue 48 and Avenue 46);
- Dillon Road (north of Interstate-10) 134-foot right-of-way and 110-foot right-of-way;
- Harrison Street (Avenue 44 to Vista Del Norte) 88-foot right-of-way;



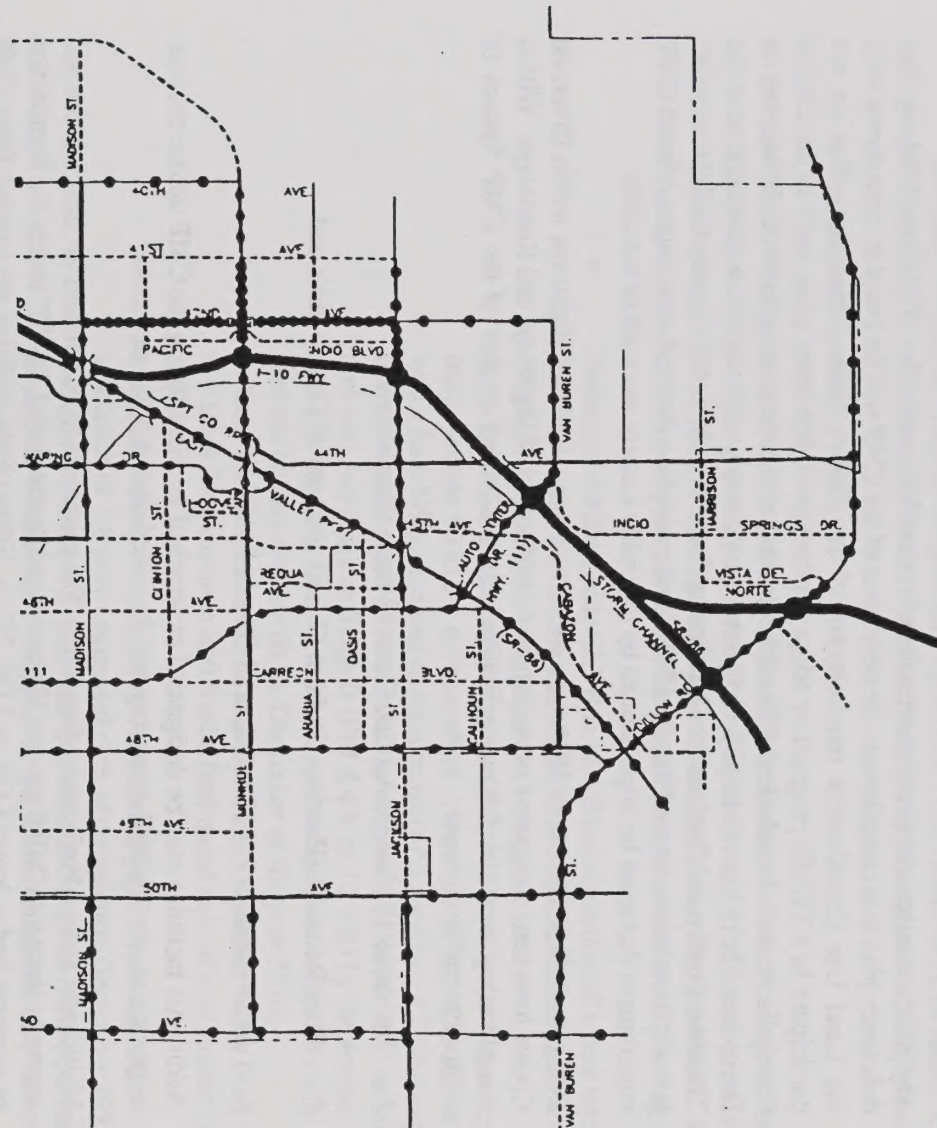
Source: Endo Engineering

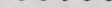
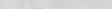
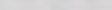
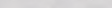


La Quinta Circulation Plan

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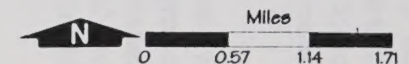
Figure No. 3.5-7



Legend		<u>ROW</u> Varies
	Freeway	
	Augmented Arterial	134'
	Augmented Major (A)	120'
	Augmented Major (B)	100'
	Arterial	110'
	Major	100'
	Secondary	88'
	Collector	66'
	Study Area Boundary	

Revised 10/7/93

Source: Endo Engineering



Indio Circulation Plan

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Figure No. 3.5-8

- Indio Springs Drive (between Van Buren Street and Dillon Road) 66 to 88-foot right-of-way;
- Jackson Street (Avenue 52 to Avenue 50) 110-foot right-of-way;
- Van Buren Street (from Avenue 48 to Grapefruit Blvd.) 100-foot right-of-way;
- Van Buren Street (from Avenue 52 to Rancho Coachella Parkway) 120-foot right-of-way; and
- Vista Del Norte (west of Dillon Road) 88-foot right-of-way.

Riverside County Congestion Management Program

The Riverside County Transportation Commission (RCTC) is the Congestion Management Agency (CMA) responsible for preparing Riverside County's Congestion Management Program (CMP). The CMP is an effort to more directly link land use, transportation and air quality, thereby prompting reasonable growth management programs that will more effectively utilize new and existing transportation funds, alleviate traffic congestion and related impacts and improve air quality.

Any jurisdiction that adopts a Transportation Uniform Mitigation Fee (TUMF) or a subregional deficiency plan that compliments the objectives of the CMP will be found in compliance with the Land Use Coordination requirements of the CMP. Those jurisdictions that do not participate in a TUMF program or adopt a subregional deficiency plan, such as the City of Coachella, must follow the Land Use Coordination process described in the CMP adopted on December 13, 1995. All local jurisdictions must comply with requirements described in the TDM/Air Quality and Conformance Monitoring Elements. A "Local Agency CMP Handbook" is incorporated as an Appendix in the CMP which provides a detailed explanation of each CMP requirement that must be implemented by Riverside County and each of the cities.

Designated CMP System of Highways and Roadways - All State Highways within Riverside County have been designated as part of the CMP System of Highways and Roadways. Within the planning area, the following facilities are designated as part of the CMP System of Highways and Roadways:

- * Interstate 10 (San Bernardino County line to State line);
- * State Route 86 (Harrison St. from SR 111 to Imperial County line); and
- * State Route 111 (I-10 to Imperial County line).

Additional facilities may be designated as principal arterials during the CMP update process. In particular, the SR 86 Expressway may be added during future updates.

Multimodal System Performance Standards - The minimum LOS standard for intersections and segments along the CMP System of Highways and Roadways is LOS "E" unless the intersection or segment had a lower LOS or LOS "F" in 1991. Such facilities are exempt from CMP deficiency plan requirements. However, if the LOS is improved to "E" or better since 1991, the LOS must then be maintained. Intersections or street segments that have dropped to LOS "F" since 1991 will be subject to the development of a deficiency plan prepared by the affected local agencies.

LOS Deficiency Plans - A city or county may designate individual deficient segments or intersections which do not meet the established LOS standards, if prior to the designation at a noticed public hearing, the city or county has adopted a deficiency plan. The RCTC will prepare

deficiency plans on the State Highway System when deficiencies are identified by local jurisdictions. If transit or Alternative Mass Transit Systems are included as mitigation measures to offset impacts on the CMP System, the minimum Transit/Alternative Mass Transit System Standards must be maintained. Local agencies will be required to identify mitigation measures or improvements to these systems necessary to maintain those minimum standards.

Transportation Demand Management/Air Quality Provisions - The CMP includes alternatives to single occupant auto use, such as transit, and van and carpooling; and must promote strategies to manage overall travel demand such as jobs/housing balance, flextime, telecommuting and parking strategies. Local agencies must adopt a trip reduction and travel demand ordinance and comply with annual CMP monitoring requirements to comply with CMP statutes. The CMP includes model ordinances in an Appendix.

Capital Improvement Program (CIP) - The CIP is a 7-year program that includes all projects which maintain or improve the minimum traffic LOS or transit performance standards as well as conform to transportation-related emission air quality mitigation measures. Projects in the CIP may be incorporated into the Regional Transportation Improvement Program (RTIP) for the programming of Flexible Congestion Relief (FCR) and Urban and Commuter Rail funds. CIP projects also receive priority for state Traffic Systems Management (TSM) funds.

Capital Improvement Projects

The SCAG *Regional Mobility Element* (June 1994) represents the long range transportation plan for the SCAG region. It outlines the region's 20-year strategy for meeting mobility goals and serves as the \$71 billion master funding list for all transportation improvements. Riverside County Freeway and arterial projects within the planning area include the following:

- **Interstate-10** (Post Mile 62.3 R to 63.6 R) construction of a new interchange 2.7 miles east to 4.0 miles east of Dillon Road (Smokey Gulch) with a June 1997 estimated date of completion;
- **State Route 86 Expressway** improvements: (1) construct 4-lane expressway from Avenue 66 to 0.1 mile south of Avenue 58 (Post Mile 10.7 R to 15.2) with a June 1996 estimated completion date; (2) construct a 2-lane expressway from 0.3 miles south of Avenue 82 to Avenue 66 (Route 195) as Stage I and then add two lanes as Stage II (PM 2.4 R to 10.7 R) by September of 1996; and (3) upgrade from a 4-lane expressway to a 4-lane freeway between Avenue 56 and Avenue 66 by December of the year 2010;
- **Avenue 48**, Van Buren Street to Grapefruit Boulevard, widen from 2-3 lanes to 4 lanes for a distance of 0.5 mile (estimated date of completion December 1994);
- **Madison Street**, Avenue 54 to Avenue 52, gap closure construct 4 lanes for a distance of 1.0 mile (estimated date of completion December 1997);
- **Avenue 56**, from 0.5 mile east of Madison Street to Monroe Street, widen from 2 to 4 lanes for a distance of 0.5 mile (estimated date of completion December 1998);
- **Avenue 56**, from Harrison Street to Tyler Street, widen from 2 to 4 lanes for a distance of 1.0 mile (estimated date of completion December 1998);

There are numerous Capital Improvement Projects in progress within the City of Coachella. These include:

- **streetscape projects** (Sixth Street, Harrison Street, Avenue 50, Avenue 52, Grapefruit Boulevard);

- **conceptual design projects** (Entertainment Zone, University of the California, Downtown Commercial District, bus shelters); and
- **engineering projects** (Sixth Street utility relocation, Commercial District utility relocation and/or undergrounding, Harrison Street landscaping/irrigation, signalization, crosswalk signals, bus stops and shelters, medians, Avenue 50 repaving SP railroad crossing and new Highway 86 intersection connecting road, Avenue 52 improvements including bridge over Whitewater Wash and new Highway 86 intersection, Avenue 48 improvements, Dillon Road improvements, Avenue 50/ Highway 111/Railroad grade separation, Avenue 50/storm channel bridge.

Truck Routes

Truck routes are designed to provide access to areas of the City that utilize truck service (principally commercial and industrial areas) and to provide through-truck traffic with efficient routes which avoid residential areas and congested streets as much as possible. Trucks making local deliveries are allowed to divert from these routes to businesses. Streets used for truck routes are designed to support the weight of the heavier vehicles and have intersections with sufficient room for turning movements. Figure 3.5-9, Currently Designated Truck Routes, depicts the existing truck routes within the City of Coachella.

The *Calexico/Coachella Valley/Los Angeles Rail Corridor Study* states that 900,000 trucks currently cross the California Mexico border each year at Calexico. Of that total, 16 percent have origins or destinations inside Imperial County and/or San Diego County but the remaining 84 percent either travel east into Arizona or along State Highway 86, State Highway 111 or other heavily congested coastal corridors. The North American Free Trade Agreement (NAFTA) is likely to cause significant increases in goods movement across the California-Mexico border at Calexico.³

Alternate Transportation Modes

Bus Service

Bus service in the Coachella area is provided by the SunLine Transit Agency. Transit routes servicing Coachella include Routes 80, 90, 91 and 111. Route 80 serves mainly the City of Indio but comes within one quarter mile of the city limits of Coachella at the corner of Oasis and Avenue 48. Route 90 serves the cities of Indio and Coachella, while Route 91 serves the communities of Indio, Coachella, Thermal and Mecca. See Section 3.11.7, Public Transportation for further information.

SunLine Transit is anticipating the construction of a people-mover system in the Coachella Valley by the year 2000. At the present time, no studies have been prepared to determine the feasibility of such a system nor the routing necessary to provide the best service. The current patterns and density of development within the Coachella Valley would appear to make the feasibility of such a system difficult. Should the appropriate studies be favorable toward the operation of a light rail system within the Valley, major thoroughfares could serve as the carriers.

³ DKS Associates, Gensler and Associates and NBS Lowry; *Coachella Valley Multimodal Transportation Planning Study*; October 1995.



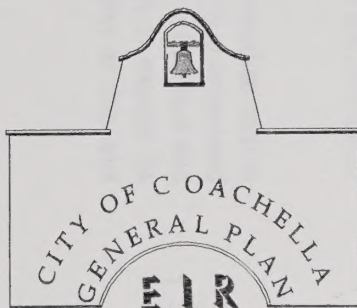
Source: Endo Engineering



Currently Designated Truck Routes

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Figure No. 3.5-9



Rail Service

Freight railroad service is provided by the Southern Pacific Railroad in the City of Coachella. A Southern Pacific Railroad line passes diagonally through the planning area parallel and adjacent to the east side of Grapefruit Boulevard.

Data on railroad operations obtained from the Southern Pacific Transportation Company indicates that this line is used only for freight train operations and 40 trains per day typically pass through the planning area with an average of 80 cars per train (resulting in a train length of 5,200 feet). Approximately 5 of the trains pass through the planning area during the evening hours (between 7:00 PM and 10:00 PM) and another four trains pass through the area during the nighttime hours (between 10:00 PM and 7:00 AM). A typical train is pulled by 4 engines and typical train speeds are 50 miles per hour.

The nearest passenger rail service is AMTRAK, which can be obtained in the City of Indio. The Southern Pacific rail line provides two daily Amtrak service stops to Arizona through the City of Indio. Metrolink commuter rail service is being proposed between Los Angeles and the Coachella Valley using the Southern Pacific Railroad tracks. The proposal includes three stops in the Valley including one stop at the Jackson Street Multimodal Station in the City of Indio. A proposed 2-year seasonal weekend demonstration project would test the market in an effort to prove that ridership levels are sufficient to maintain State minimum fare-box requirements for year-round heavy rail service between the Los Angeles/Coachella Valley/Imperial Valley corridors.

Coordination of passenger rail service with commercial vehicle operation forecasts to and from Mexico (which are expected to grow to 2,500 daily commercial vehicle operations due to the North America Free Trade Agreement (NAFTA)) could potentially involve NAFTA funding for construction of a second rail line

People Mover/Light Rail Transit

The *Coachella Valley Regional Mobility Program* (SunLine Transit Agency; 12/93) identified three primary light rail or people mover corridors with the potential for supporting fixed route or fixed guideway transit linking areas of concentrated population and/or employment. These include:

- **the Highway 111 Corridor** (from the proposed Indio Rail/Bus Terminal westerly and northerly);
- **the Whitewater River Corridor** (north of Highway 111); and
- **the Southern Pacific R.O.W./Interstate-10 Corridor** (the Southern Pacific Railway corridor within the planning area and the Interstate-10 corridor north of the SR-86 Expressway).

Opportunities for multimodal hubs currently exist at Thermal Airport and the proposed Indio Rail/Bus Terminal. This terminal has the potential to expand into a significant east valley multimodal hub over the long term.

Airport

Thermal Airport is located in the southern portion of the study area, just south of the city limits and is currently used as a general aviation airport. The airport is bounded on the west by State Route 86, on the north by Avenue 56 (Airport Boulevard), on the east by Polk Street and on the south by Avenue 60.

The airport has two runways. The primary runway is oriented in a north to south direction and is approximately 5,000 feet in length and 150 feet wide. The secondary runway (the crosswind runway) is oriented in a northwest to southeast direction and is approximately 5,000 feet in length and 100 feet wide. The taxiway system includes seven separate parallel, connecting, and perimeter taxiway segments. These taxiways provide access to the various facilities on the airport. Existing taxiways were constructed as part of the original airport design.

Airfield facilities include runways, taxiways, airfield lighting and navigational aids. Lighting aids available to facilitate identification, approach, landing, and taxi operations during nighttime operations and in adverse weather conditions include a rotating beacon, runway edge lights, runway threshold lights, and taxiway edge lights for portions of the taxiway system. Navigational aids include the Thermal Airport Very High Frequency (VHF) Omnidirectional Range/Tactical Air Navigation (VORTAC) facility and a Visual Approach Slope Indicator (VASI) system for the primary runway. Terminal area facilities include a terminal/Fixed Base Operator (FBO) building, aircraft hangars, aircraft parking apron and fuel storage and dispensing equipment.

The 1995 aviation demand forecast included 63 based aircraft with 91,800 annual aircraft operations (of which 12,575 occur in the peak month, 405 occur on the design day, 498 occur on a busy day, and 61 occur during the design hour).

A number of existing facilities at Thermal Airport are not adequate to accommodate current demands. Rapid growth anticipated in this area will increase aviation activity and compound these deficiencies. This area attracts visitors year-round and is emerging as a business and commerce center. Thermal Airport will be faced with increasing pressure to expand its capabilities and services to meet the growing aviation demands of the region as this area continues to grow.

The Thermal Airport Master Plan Study evaluated existing conditions at the airport in 1990 and recommended development that would enable the airport to meet future aviation needs through a 20-year planning period. Key improvements would include runway extensions, property acquisition, and facility construction.

In view of the proximity of major airline service with reasonable air fares at Palm Springs Regional Airport, it is anticipated that the demand for commercial jet service would not be likely to occur at Thermal Airport until the end of the 20-year planning period. However, commercial demand at Thermal Airport could change drastically over a very short period with a significant expansion of the resort and convention facilities in the eastern Coachella Valley or the establishment of a Business Enterprise Zone.

The potential for air cargo activities at Thermal Airport is determined by the demand for: overnight package service, an air cargo hub, transporting agricultural products of the Coachella Valley and Imperial Valley by air, and air cargo related to potential industrial development on and around Thermal Airport. Agricultural products from the Lower Coachella Valley and Imperial Valley are normally trucked to Los Angeles for shipment throughout the nation and overseas. To justify air cargo development, any market needs to have a base of imports by air as well as exports. Industrial development within the planning area with air shipping needs would greatly improve the prospects for air cargo at Thermal Airport.

Thermal Airport has excellent regional access from Harrison Street, Grapefruit Boulevard and Interstate-10. Local access to the existing terminal area is provided by Airport Boulevard (from the east and west) and by Tyler Street (from the north). Depending upon the final locations of the potential airline terminal area, the general aviation area, and the industrial park development, several of the local streets in the airport vicinity may need to be improved, particularly those providing direct access to Grapefruit Boulevard, the State Route 86 Expressway, and Interstate-10.

Non-Motorized Transportation

The use of bicycles instead of automobiles as a means of transportation improves health and fitness, provides enjoyment, reduces air pollution, traffic congestion, energy consumption and transportation costs. These benefits justify local and regional government recognition of bicycles as a viable transportation mode for local trips as well as the development and improvement of facilities to accommodate safe and efficient bicycle use.

The City of Coachella currently provides 3.1 miles of bike lanes (signed and striped bike lanes adjacent to the street curb or striped paved shoulder). There are no bike paths or bike routes within the City of Coachella at present. The *Coachella Valley Multimodal Transportation Planning Study* includes 8.58 miles of proposed primary bikeways and 6.2 miles of proposed secondary bikeways for a total of 11.68 new bikeway miles within the City of Coachella.⁴

⁴ DKS Associates, Gensler and Associates and NBS Lowry; *Coachella Valley Multimodal Transportation Planning Study*; October 1995; page 2-62.

Figure 3.5-10, Currently Proposed Non-motorized Facilities, depicts the currently proposed non-motorized facilities within the planning area, based upon information provided by the City of Indio, the City of La Quinta, and the Coachella Valley Association of Governments (per the *Coachella Valley Non-Motorized Transportation Element* (August 1995 Revision)). As shown therein, a Class I multi-use trail is proposed in the Coachella Valley Storm Channel (in the vicinity of Auto Center Drive) that extends southerly along Van Buren Street and Cabazon Avenue.

Class II/Class III bikeways are currently proposed along numerous streets throughout the planning area (including Grapefruit Boulevard, Airport Boulevard, Avenue 52, Harrison Street, 44th Avenue and Dillon Road). Unpaved trails are proposed in the Coachella Valley Storm Channel (south of Auto Center Drive); along Dillon Road; along a portion of the All American Canal; and north of Interstate-10.

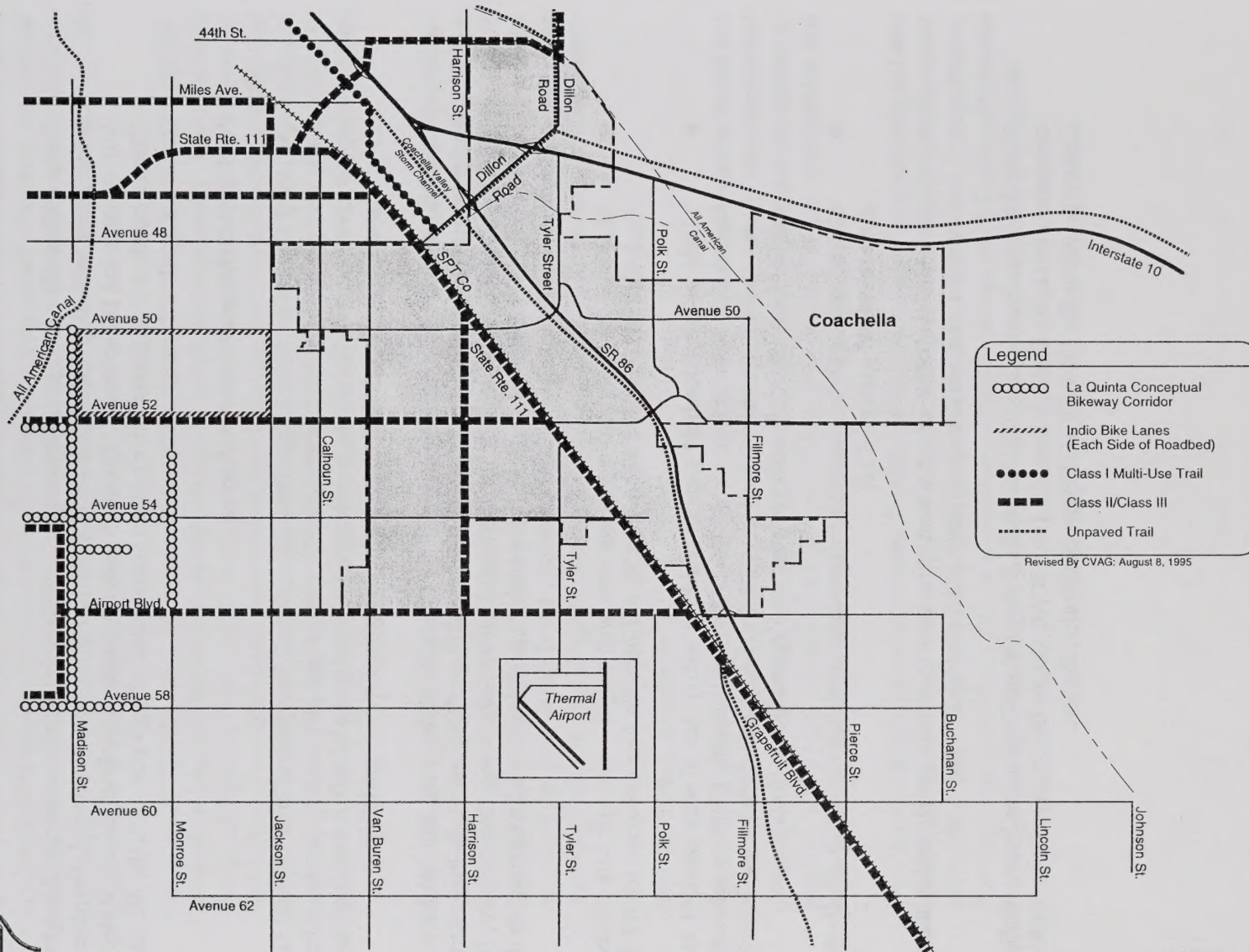
1995 CVAG Origin-Destination Survey

The 1995 Coachella Valley Origin-Destination Survey incorporated over 100,000 pieces of travel data provided by 724 households, 313 visitors, and 205 transit riders regarding their typical travel patterns. The survey was designed to identify modal split information and other travel characteristics for use in updating and refining the CVATS modeling.

Communities within the eastern portion of the Coachella Valley were found to have similar socioeconomic characteristics and travel patterns. The City of Coachella is in the eastern zone, which also includes: Thousand Palms, Bermuda Dunes, Indio, Mecca, North Shore, Thermal and Salton Sea. The trip making data indicated that travel behavior of people within the City of Coachella had the following characteristics:

- 28.2% of the household trips associated with people within the City of Coachella Analysis Zone remained within the City of Coachella Analysis Zone 10 (AZ 10);
- 71.8% of the household trips of residents within AZ 10 were destined for other surrounding areas as follows: 25.6% to Indio and vicinity, 17.9% to unincorporated areas, 12.8% to the Palm Desert area, 7.7% to La Quinta; 2.6% each to Palm Springs and Indian Wells; 1.3% each to Cathedral City and Desert Hot Springs;
- 80% of the transit trips associated with people within the City of Coachella Analysis Zone remained within AZ 10;
- the remaining 20% of the transit trips associated with people within the City of Coachella Analysis Zone were destined for the City of Indio.

Table 3.5-5 summarizes the 1995 Coachella Valley Origin-Destination Survey findings and compares them to the findings from the 1991 SCAG Origin-Destination Survey of Riverside County as well as the 1985 CVAG Origin-Destination Survey.

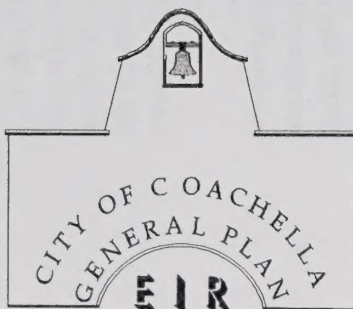


Source: Endo Engineering

Currently Proposed Non-Motorized Facilities

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Figure No. 3.5-10



**Table 3.5-5
Origin-Destination Study Findings Comparison***

Characteristic	1991 SCAG ^b Riverside Co.	1985 CVAG ^c O-D	1995 CVAG ^d O-D
Persons per Household	3.1	2.2	2.4
Vehicles per Household	1.9	1.81	1.8
Total Trips per Household	8.4	4.6	5.2
Average Vehicle Occupancy ^e	1.51	1.48	1.52
Average Travel Times (Minutes) ^f	22.5	21.5	18.5
Home-Work Travel Time (Minutes) ^g	32.0	20.3	20.4

a. Source: 1995 Coachella Valley Origin Destination Survey; Valley Research and Planning Associates and DKS Associates; October 1995; Table 7-1.

b. County totals from 1991 Southern California Origin Destination Survey: Summary Findings; February 1993.

c. Coachella Valley Area Transportation Study; December 1985, based on 1980 census.

d. 1995 Coachella Valley Origin Destination Survey; October 1995.

e. Vehicle occupancy averaged for all trip purposes.

f. Average travel times for all trip purposes by all trip modes.

g. Average travel times for home-work trips by all trip modes.

The 1995 Coachella Valley Origin-Destination Survey concluded from 1994 Caltrans counts at cordon stations on State Highways that approximately 12,570 trips daily (or ten percent of the daily vehicle trips) represent external trips that pass through the Coachella Valley. Of that total, 1,410 pass-thru trips were on Interstate-10 east of Cotton Springs Road, 350 pass-thru trips were on Grapefruit Boulevard east of SR 195 and 1,020 pass thru trips were on Harrison Street, south of SR 195. The North American Free Trade Agreement may increase this number significantly in the years ahead.

Future Circulation Conditions

There are sizable areas within the Planning Area that have yet to be developed. The rapid growth in population and tourism expected over the next 20 years will lead to increasingly severe traffic congestion without new facilities to accommodate the projected growth. Consequently, the planning of an adequate circulation system to support future development and tourism as well as traffic associated with the North American Free Trade Agreement is vital. The proposed Coachella Circulation Plan must anticipate travel demands within the study area upon buildout of the Coachella Land Use Plan and provide a map of desired alignments and classifications of master planned roadways.

The Coachella General Plan Transportation Model (CGPT Model), a city-wide transportation planning model, was developed by Endo Engineering to assist in the evaluation and refinement of local growth policies as part of the Coachella General Plan Update process. To minimize model development costs and maintain consistency with sub-regional transportation modeling, the CGPT Model was based on the Coachella Valley Area Transportation Study Model (CVATS Model).

The CVATS Model forecasts peak season (winter months) average weekday travel demands. It should be noted, however, that the model is limited in its ability to forecast turning movement volumes at intersections. Intersection level forecasting is difficult and requires more detailed models. Therefore, daily traffic volume projections were made but peak hour forecasts for intersections were not developed.

The roadway network modeled excluded local streets because it is impractical to model the regional circulation system to that level of detail.

Coachella General Plan Transportation Model

Proposed land use information, socioeconomic and highway network assumptions were utilized to project future traffic demands upon buildout of the proposed General Plan by refining the latest release of the CVATS Model.

The goal of the circulation modeling was to satisfy local transportation model development needs by refining the CVATS Model attributes and characteristics to better replicate local land use conditions and travel characteristics and produce accurate and reasonable traffic forecasts for local conditions upon buildout of the City of Coachella General Plan.

CVAG's *Consistency Guidelines For Transportation Modeling and Traffic Forecasting Within Riverside County/Coachella Valley* (November 1994) were followed, when possible, to maintain consistency with the CVATS Sub-Regional Model and CVAG's officially adopted socioeconomic data base. However, the use of the CVATS Model as a city-wide buildout model created inherent inconsistencies in that its horizon year is 2010 rather than the Coachella General Plan buildout year (post 2020).

Additional network and zone detail were added to the Coachella General Plan Transportation (CGPT) Model to allow it to provide better resolution on streets within the Planning Area and address transportation local issues.

The CGPT Model included the proposed General Plan buildout land use data as well as highway network changes to better reflect General Plan buildout conditions within the Planning Area. The CGPT Model was modified to include the following highway network changes:

- the Smokey Gulch Interchange at Interstate-10;
- the addition of two new crossings of the All American Canal (at Avenue 52 and Airport Boulevard);
- the Polk Street realignment (between Dillon Road and Avenue 50);
- the realignment of Avenue 60 to permit the future extension of the Thermal Airport runway;
- the downgrading of Avenue 60 to collector status and upgrading of Avenue 62 to primary arterial status to take advantage of the SR-86 Freeway interchange at Avenue 62 (given the future Thermal Airport Runway Expansion and break in Avenue 60); and
- other network changes designed to better reflect City circulation policies rather than the Riverside County Circulation Plan.

Consistency With Sub-Regional Circulation Modeling

Future traffic forecasts generated by circulation models are the basis of Congestion Management Plans, Capital Improvement Plans, highway project design decisions, transportation planning and land use decisions. Consequently, it is desirable for regional, sub-regional and local jurisdictions to have a consistent basis for evaluating transportation projects and programs.

However, buildout of the land use and transportation facilities within the Coachella General Plan Update

However, buildout of the land use and transportation facilities within the Coachella General Plan Update Planning Area must be evaluated to demonstrate consistency between the proposed Land Use Element and Circulation Element of the Coachella General Plan. Although the CVATS Model has a year 2010 horizon year, the CGPT model incorporates a hybrid of land use assumptions to replicate post 2020 conditions.

Also, although the CVATS Model horizon year 2010 highway network was constrained to funded highway projects, the City of Coachella General Plan Transportation Model buildout highway network was not constrained to funded highway projects and incorporated network changes to reflect post 2020 conditions. Consequently, it was not possible to satisfy local transportation model development needs while maintaining consistency with the CVATS Model.

Future Traffic Volume Forecast

Future traffic demands are directly related to the type and intensity of future land uses. Figure 3.5-11, Future Daily Traffic Volumes, displays the peak season average weekday traffic volume projections from the CGPT Model for conditions upon buildout of the proposed Coachella General Plan.

The projected General Plan buildout traffic volume on five roadway links will exceed the 50,000 vehicle per day "design" capacity of Major Arterial Highways. These links include:

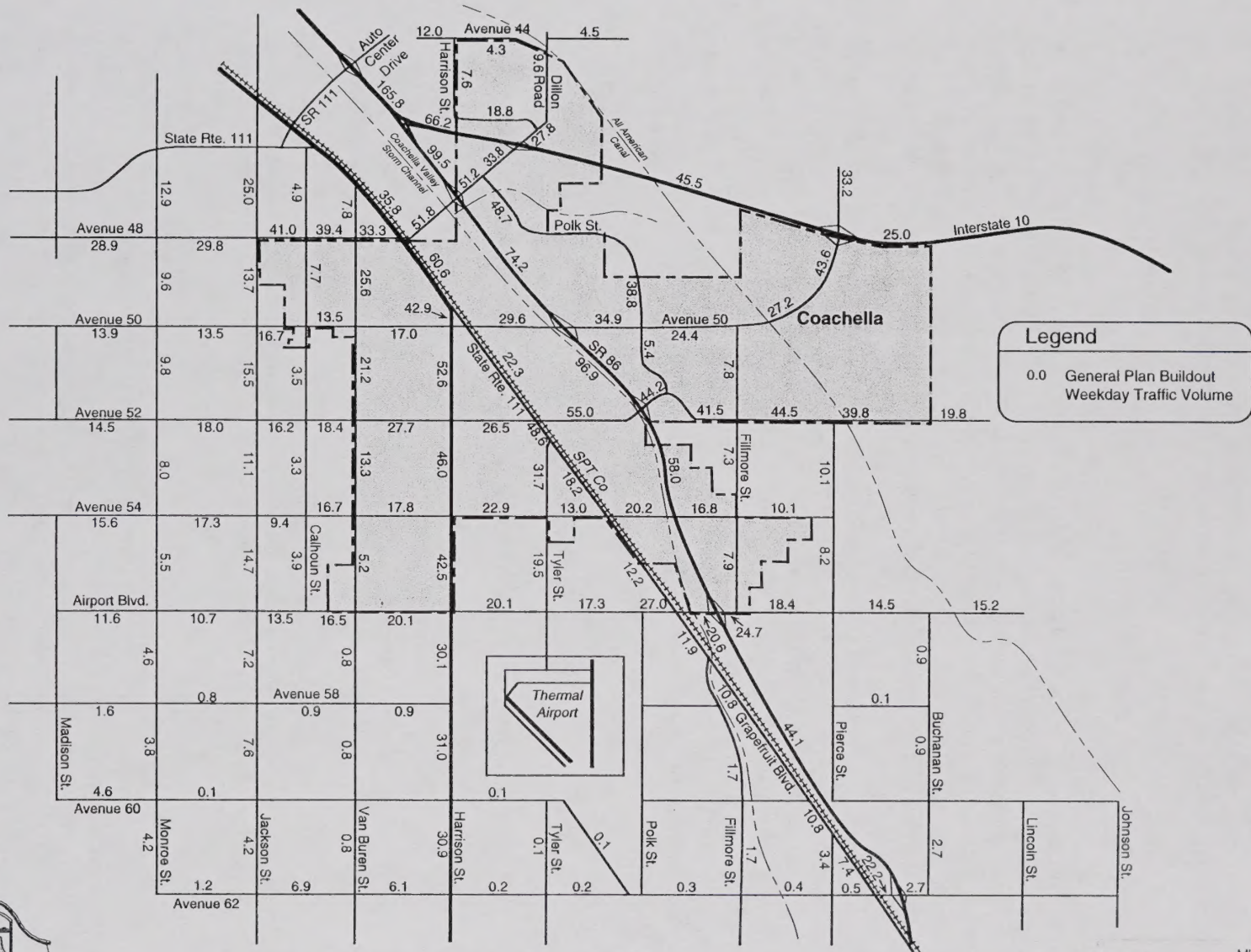
- Dillon Road (east and west of the SR-86 Freeway);
- Grapefruit Boulevard (between Harrison Street and Dillon Road);
- Harrison Street (between Avenue 50 and Avenue 52); and
- Avenue 52 (between Grapefruit Boulevard and the SR-86 Freeway).

Like today, Grapefruit Boulevard (south of Dillon Road) is projected to be the most heavily used surface street in the Planning Area upon buildout of the General Plan. The Dillon Road links on either side of the State Route 86 Freeway will carry traffic from Grapefruit Boulevard directly to the State Route 86 Freeway or Interstate-10. Harrison Street is projected to carry appreciable through traffic into the Planning Area at Avenue 62 then north to Grapefruit Boulevard and the two freeway interchanges at Dillon Road. Since these links serve the highest traffic demands during the peak season, it is important that they provide sufficient capacity to ensure acceptable levels of service.

To achieve this goal, the City of Coachella has developed a new master planned roadway classification for an Enhanced Major Arterial. This roadway classification will have similar design characteristics to a Major Arterial except with an additional 24 feet of roadbed to accommodate two additional 12-foot travel lanes within the 144-foot right-of-way (see Figure 3.5-4). It will have a design capacity of 66,500 vehicles per day, as shown in Table 3.5-2. All five of the roadway links with General Plan Buildout daily volumes in excess of 50,000 identified above were classified as Enhanced Major Arterials by the City of Coachella.

Proposed Street and Highway Plan

To achieve the City's goals and objectives, a street and highway system is needed which improves access and provides better options for through vehicle trips within the City. A public transportation system and a pedestrian and bicycle circulation system connecting employment, shopping, residential, recreation and transit destinations are also needed.



Source: Endo Engineering

Future Daily Traffic Volumes (in Thousands)

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Figure No. 3.5-11



Travel patterns in the planning area include a substantial number of trips oriented in a northeast-southwest direction. This pattern has created problems for Coachella, whose arterial grid system does not follow the preferred travel direction.

To adequately serve projected traffic volumes upon General Plan buildout, the Coachella roadway network will require considerable improvement. A roadway plan that meets the desires of the community for mobility and accessibility while supporting the development intensity anticipated in the Land Use Element has been developed by the City. It includes high volume enhanced major arterial corridors and grade separations to adequately accommodate some of the regional through traffic and divert it from the City street system onto the freeways. The new high-volume corridors will also link the freeways with the future growth centers in the planning area.

Figure 3.5-12, Circulation Policy Diagram, depicts the proposed update to the Coachella Circulation Policy Diagram. It reflects the circulation system required to satisfy existing and General Plan buildout travel demands while maintaining system efficiency and safety as well as preserving community values and character. It includes a classification system that applies to all roadways that serve the City of Coachella and identifies specific improvements that will be required to implement this plan.

Designated streets are shown within the City limits as well as for the surrounding planning area that has been defined for the General Plan Update. Any permanent closure to through traffic or relocation of the designated streets will require a General Plan Amendment.

Typical cross-sections that will be used to implement the circulation plan are provided in Figure 3.5-4 for each roadway classification. Recommended minimum street design standards are provided in Table 3.5-2.

The Coachella Circulation Policy Diagram indicates a number of improvements with regard to the existing roadway system within the planning area. The following are the more important improvements that will need to be implemented:

- the Smokey Gulch Interchange at Interstate-10;
- the addition of two new crossings of the All American Canal (at Avenue 52 and Airport Boulevard);
- the Polk Street realignment (between Dillon Road and Avenue 50);
- the realignment of Avenue 60 to permit the future extension of the Thermal Airport runway;
- the upgrading of Avenue 62 to primary arterial status to take advantage of the SR-86 Freeway interchange at Avenue 62 (given the future Thermal Airport Runway Expansion and break in Avenue 60); and

General Plan Buildout Volume-to-Capacity Analysis

A comparison of future daily traffic volumes to the master planned daily "design" capacity gives the proportion of the roadway capacity that will be utilized by future traffic volumes upon General Plan buildout. A volume-to-capacity (V/C) ratio of 1.0 indicates that the facility is handling the maximum traffic volume that it can accommodate while maintaining the level of service deemed appropriate for design purposes (LOS D). Volume-to-capacity ratios smaller than 1.0 imply better operational characteristics and levels of service, whereas ratios which exceed 1.0 imply less favorable operating conditions and lower levels of service.



Source: Endo Engineering

Circulation Policy Diagram

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Figure No. 3.5-12

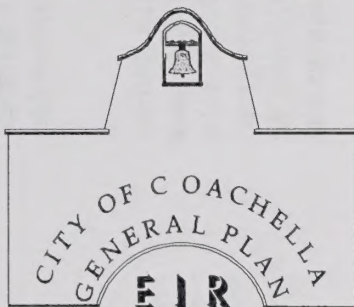


Figure 3.5-13, Future Daily V/C Ratio and LOS, illustrates the future daily volume-to-capacity ratios and levels of service within the Planning Area. As shown therein, the circulation plan shown in Figure 3.5-13 will provide LOS D or better operation on a daily basis upon General Plan buildout. The vast majority of the roadways (71 links) serve relatively low traffic demands with motorists experiencing free flowing LOS A conditions on a daily basis. Slightly restricted but reasonably unimpeded conditions can be seen, where LOS B appears (along 32 links). Stable operation at lower average travel speeds occurs where LOS C is shown (on 17 links).

Grapefruit Boulevard (south of Dillon Road) is projected to be the most heavily used roadway link in the Planning Area upon buildout of the General Plan. This link is projected to have a daily volume-to-capacity ratio of 0.91 which means that it will carry traffic volumes that comprise 91 percent of its daily "design" capacity. South of Avenue 52, Grapefruit Boulevard is expected to have a daily V/C ratio of 0.93, which also implies LOS D on a daily basis.

In addition to the two links on Grapefruit Boulevard discussed above, seven other roadway links will carry daily traffic volumes that equal or exceed 90% of their master planned capacity and provide LOS D. These links include: (1) Harrison Street (four links between Avenue 52 and Avenue 62); Avenue 50 (north of I-10); Polk Street (south of Dillon Road); and Tyler Street (north of Avenue 54).

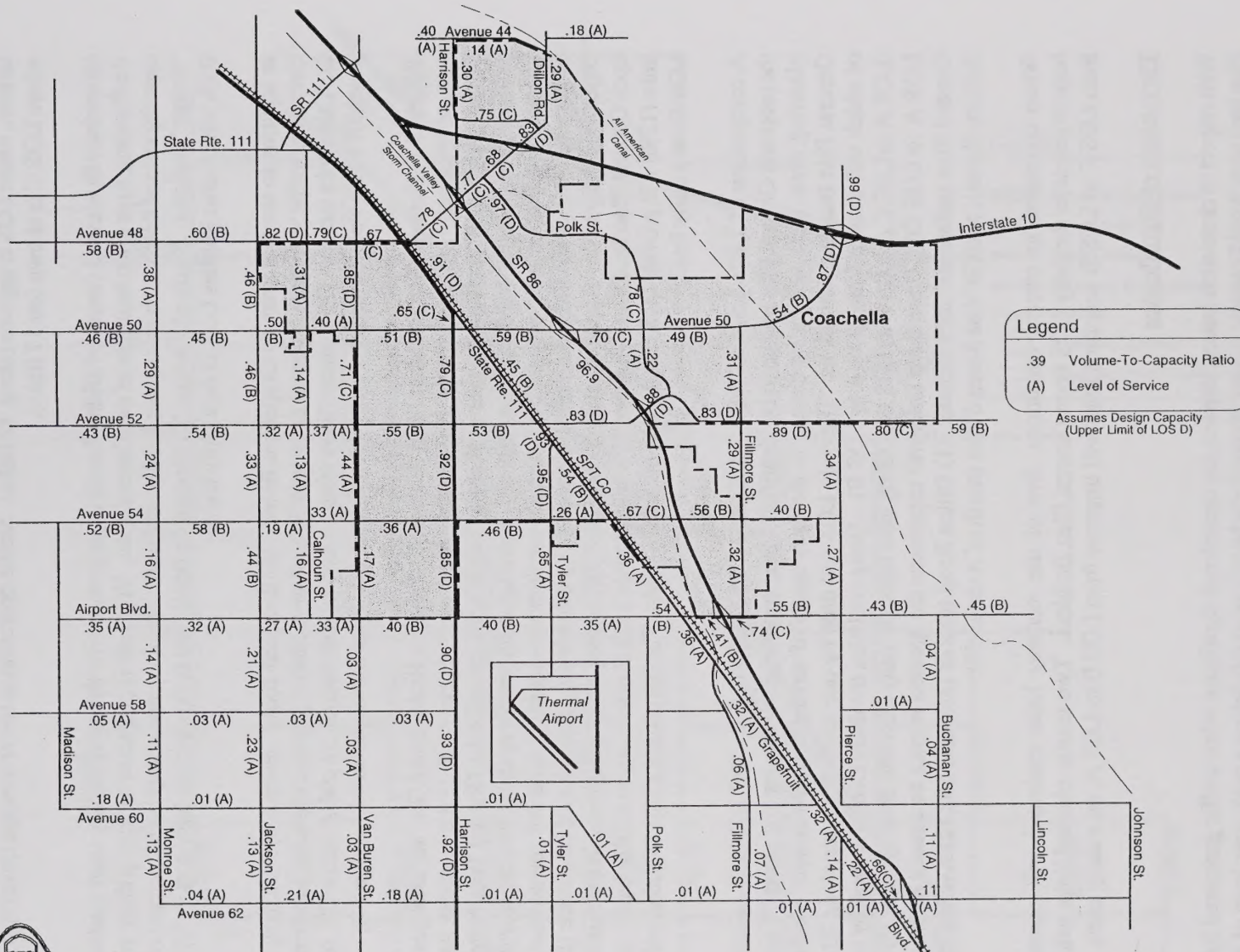
Table 3.5-6, General Plan Buildout Daily Volume to Capacity Ratios and LOS, summarizes the daily volume-to-capacity ratio and level of service analysis for each roadway link in the Planning Area where future daily traffic projections were available. Table 3.5-6 includes the General Plan buildout daily volume, the master planned daily design capacity (based upon full roadway improvements per the master planned classification cross-section) the future daily volume-to-capacity ratios and corresponding levels of service. All of the links analyzed are projected to provide acceptable levels of service (LOS D or better) on a daily basis. Approximately 52% of the 138 roadway links analyzed will operate at LOS A upon General Plan Buildout. Another 23% will provide LOS B operation on a daily basis. Seventeen links (12%) will provide LOS C operation on a daily basis. The remaining 13% (18 links) will provide LOS D on a daily basis.

A comparison of Table 3.5-4 to Table 3.5-6 allows the change in daily V/C and LOS associated with the proposed General Plan update to be identified. This comparison indicates that along 25 links in the planning area, there will be no change in the daily levels of service between current conditions and General Plan buildout conditions. The daily LOS will drop by one level of service along 20 links (15 of which will change from LOS A to LOS B). Along six links, the daily LOS will drop by two levels (LOS A to LOS C or LOS B to LOS D). Along three links, the daily LOS will drop by three levels (from LOS A to LOS D). These three links will experience the greatest impact as a result of the proposed General Plan update and they include: (1) Dillon Road (east of Interstate 10); (2) Avenue 48 (east of Jackson Street); and (3) Van Buren Street (north of Avenue 50).

When compared to current conditions, five of the roadway links evaluated will experience an improvement in the daily LOS upon General Plan Buildout. Two master planned links will improve from LOS C to LOS B and three links will improve from LOS B to LOS A, on a daily basis.

Thresholds of Significance

With respect to circulation issues, impacts are considered significant when traffic generated by General Plan land uses would cause a master planned roadway link to fall below a peak hour level of service D or if the General Plan did not provide for an integrated system of roadway, rail, air, bicycle, and pedestrian transportation facilities to support General Plan land uses.



Source: Endo Engineering

Future Daily V/C Ratio and LOS

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Figure No. 3.5-13

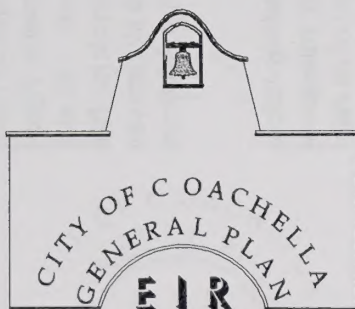


Table 3.5-6
General Plan Buildout Daily Volume-To-Capacity Ratios
and Levels of Service

Roadway Link	Buildout ADT	Daily Capacity ^a (Veh./Day)	V/C ^b Ratio	Level of Service
Avenue 44				
-W/O Harrison St.	12,000	30000	0.40	A
-E/O Harrison St.	4,300	30000	0.14	A
-E/O Dillon St.	4,500	25000	0.18	A
Vista Del Norte				
-W/O Dillon Road	18,800	25000	0.75	C
Grapefruit Blvd./SR 111				
-S/O Dillon Road	60,600	66500	0.91	D
-S/O Harrison St.	21,300	33500	0.64	C
-S/O Avenue 50	22,300	50000	0.45	B
-S/O Avenue 52	46,600	50000	0.93	D
-S/O Tyler St.	18,200	33500	0.54	B
-S/O Avenue 54	12,200	33500	0.36	A
-S/O Airport Blvd.	11,900	33500	0.36	A
-N/O Avenue 58	10,800	33500	0.32	A
-N/O Avenue 62	7,400	33500	0.22	A
Harrison Street				
-S/O Avenue 44	7,600	25000	0.30	A
-N/O Avenue 50	42,900	66500	0.65	C
-S/O Avenue 50	52,600	66500	0.79	C
-S/O Avenue 52	46,000	50000	0.92	D
-S/O Avenue 54	42,500	50000	0.85	D
-S/O Airport Blvd.	30,100	33500	0.90	D
-S/O Avenue 58	31,000	33500	0.93	D
-S/O Avenue 60	30,900	33500	0.92	D
Avenue 48/Dillon Road				
-W/O Monroe St.	28,900	50000	0.58	B
-W/O Jackson St.	29,800	50000	0.60	B
-E/O Jackson St.	41,000	50000	0.82	D
-W/O Van Buren St.	39,400	50000	0.79	C
-E/O Van Buren St.	33,300	50000	0.67	C
-E/O Grapefruit Blvd.	51,800	66500	0.78	C
-E/O SR 86	51,200	66500	0.77	C
-W/O Interstate 10	33,800	50000	0.68	C
-E/O Interstate 10	27,800	33500	0.83	D
-S/O 44th Avenue	9,600	33500	0.29	A
Avenue 50				
-W/O Monroe St.	13,900	30000	0.46	B
-W/O Jackson St.	13,500	30000	0.45	B
-E/O Jackson St.	16,700	33500	0.50	B
-W/O Van Buren St.	13,500	33500	0.40	A
-E/O Van Buren St.	17,000	33500	0.51	B
-E/O Grapefruit Blvd.	29,600	50000	0.59	B
-E/O State Hwy. 86	34,900	50000	0.70	C
-E/O Polk St.	24,400	50000	0.49	B

a. These values represent the master planned capacity (upper limit of LOS D) in Table 3-3.

b. These values were calculated using the capacity at the upper limit of LOS D.

Table 3.5-6 (Continued)
General Plan Buildout Daily Volume-To-Capacity Ratios
and Levels of Service

Roadway Link	Buildout ADT	Daily Capacity ^a (Veh./Day)	V/C ^b Ratio	Level of Service
Avenue 50				
-E/O Fillmore St.	27,200	50000	0.54	B
-S/O Interstate 10	43,600	50000	0.87	D
-N/O Interstate 10	33,200	33500	0.99	D
Avenue 52				
-W/O Monroe St.	14,500	33500	0.43	B
-W/O Jackson St.	18,000	33500	0.54	B
-E/O Jackson St.	16,200	50000	0.32	A
-W/O Van Buren St.	18,400	50000	0.37	A
-W/O Harrison St.	27,700	50000	0.55	B
-E/O Harrison St.	26,500	50000	0.53	B
-E/O Grapefruit Blvd.	55,000	66500	0.83	D
-E/O State Hwy. 86	44,200	50000	0.88	D
-E/O Polk St.	41,500	50000	0.83	D
-E/O Fillmore St.	44,500	50000	0.89	D
-E/O Pierce St.	39,800	50000	0.80	C
-E/O Buchanan St.	19,800	33500	0.59	B
Avenue 54				
-W/O Monroe St.	15,600	30000	0.52	B
-W/O Jackson St.	17,300	30000	0.58	B
-E/O Jackson St.	9,400	50000	0.19	A
-W/O Van Buren St.	16,700	50000	0.33	A
-W/O Harrison St.	17,800	50000	0.36	A
-E/O Harrison St.	22,900	50000	0.46	B
-W/O Grapefruit Blvd.	13,000	50000	0.26	A
-E/O Grapefruit Blvd.	20,200	30000	0.67	C
-E/O State Hwy. 86	16,800	30000	0.56	B
-E/O Fillmore St.	10,100	25000	0.40	B
Airport Blvd.				
-W/O Monroe St.	11,600	33500	0.35	A
-W/O Jackson St.	10,700	33500	0.32	A
-E/O Jackson St.	13,500	50000	0.27	A
-W/O Van Buren St.	16,500	50000	0.33	A
-W/O Harrison St.	20,100	50000	0.40	B
-E/O Harrison St.	20,100	50000	0.40	B
-W/O Polk St.	17,300	50000	0.35	A
-W/O Grapefruit Blvd.	27,000	50000	0.54	B
-E/O Grapefruit Blvd.	20,600	50000	0.41	B
-E/O State Hwy. 86	24,700	33500	0.74	C
-E/O Fillmore St.	18,400	33500	0.55	B
-E/O Pierce St.	14,500	33500	0.43	B
-E/O Buchanan St.	15,200	33500	0.45	B

a. These values represent the master planned capacity (upper limit of LOS D) in Table 3-3.

b. These values were calculated using the capacity at the upper limit of LOS D.

Table 3.5-6 (Continued)
General Plan Buildout Daily Volume-To-Capacity Ratios
and Levels of Service

Roadway Link	Buildout ADT	Daily Capacity ^a (Veh./Day)	V/C ^b Ratio	Level of Service
Avenue 58				
-W/O Monroe St.	1,600	30000	0.05	A
-W/O Jackson St.	800	30000	0.03	A
-E/O Jackson St.	900	30000	0.03	A
-W/O Harrison St.	900	30000	0.03	A
-E/O Pierce St.	100	25000	0.01	A
Avenue 60				
-W/O Monroe St.	4,600	25000	0.18	A
-W/O Jackson St.	100	25000	0.01	A
-E/O Harrison St.	100	25000	0.01	A
-E/O Tyler St.	100	25000	0.01	A
Avenue 62				
-W/O Jackson St.	1,200	33500	0.04	A
-E/O Jackson St.	6,900	33500	0.21	A
-W/O Harrison St.	6,100	33500	0.18	A
-E/O Harrison St.	200	33500	0.01	A
-E/O Tyler St.	200	33500	0.01	A
-E/O Polk St.	300	33500	0.01	A
-W/O Pierce St.	400	33500	0.01	A
-W/O Grapefruit Blvd.	500	33500	0.01	A
-E/O Grapefruit Blvd.	22,200	33500	0.66	C
-W/O Buchanan St.	2,700	25000	0.11	A
Monroe Street				
-N/O Avenue 50	9,600	25000	0.38	A
-N/O Avenue 52	9,800	33500	0.29	A
-N/O Avenue 54	8,000	33500	0.24	A
-N/O Airport Blvd.	5,500	33500	0.16	A
-S/O Airport Blvd.	4,600	33500	0.14	A
-N/O Avenue 60	3,800	33500	0.11	A
-N/O Avenue 62	4,200	33500	0.13	A
Jackson Street				
-N/O Avenue 50	13,700	30000	0.46	B
-N/O Avenue 52	15,500	33500	0.46	B
-N/O Avenue 54	11,100	33500	0.33	A
-N/O Airport Blvd.	14,700	33500	0.44	B
-N/O Avenue 58	7,200	33500	0.21	A
-N/O Avenue 60	7,600	33500	0.23	A
-N/O Avenue 62	4,200	33500	0.13	A
Calhoun Street				
-N/O Avenue 50	7,700	25000	0.31	A
-N/O Avenue 52	3,500	25000	0.14	A
-N/O Avenue 54	3,300	25000	0.13	A
-N/O Airport Blvd.	3,900	25000	0.16	A

- a. These values represent the master planned capacity (upper limit of LOS D) in Table 3-3.
b. These values were calculated using the capacity at the upper limit of LOS D.

Table 3.5-6 (Continued)
General Plan Buildout Daily Volume-To-Capacity Ratios
and Levels of Service

Roadway Link	Buildout ADT	Daily Capacity ^a (Veh./Day)	V/C ^b Ratio	Level of Service
Van Buren Street				
-N/O Avenue 50	25,600	30000	0.85	D
-N/O Avenue 52	21,200	30000	0.71	C
-N/O Avenue 54	13,300	30000	0.44	B
-N/O Airport Blvd.	5,200	30000	0.17	A
-N/O Avenue 58	800	30000	0.03	A
-N/O Avenue 60	800	30000	0.03	A
-N/O Avenue 62	800	25000	0.03	A
Polk Street				
-S/O Dillon Road	48,700	50000	0.97	D
-N/O Avenue 50	38,800	50000	0.78	C
-N/O Avenue 52	5,400	25000	0.22	A
Tyler Street				
-N/O Avenue 54	31,700	33500	0.95	D
-N/O Airport Blvd.	19,500	30000	0.65	C
-N/O Avenue 62	100	25000	0.01	A
Fillmore Street				
-N/O Avenue 52	7,800	25000	0.31	A
-N/O Avenue 54	7,300	25000	0.29	A
-N/O Airport Blvd.	7,900	25000	0.32	A
-N/O Avenue 60	1,700	30000	0.06	A
-N/O Avenue 62	1,700	25000	0.07	A
Pierce Street				
-N/O Avenue 54	10,100	30000	0.34	A
-N/O Airport Blvd.	8,200	30000	0.27	A
-N/O Avenue 62	3,400	25000	0.14	A
Buchanan Street				
-N/O Avenue 58	900	25000	0.04	A
-N/O Avenue 60	900	25000	0.04	A
-N/O Avenue 62	2,700	25000	0.11	A

a. These values represent the master planned capacity (upper limit of LOS D) in Table 3-3.

b. These values were calculated using the capacity at the upper limit of LOS D.

Project Impacts and Mitigation Provided by General Plan Policy

Roadways

Several traffic flow patterns have been identified through the Coachella General Plan Update circulation modeling process. Harrison Street is projected to carry approximately 30,000 vehicles per day, south of the Planning Area. The Grapefruit Boulevard/Dillon Road route connecting Harrison Street to the SR 86 Freeway is projected to have the highest arterial traffic volumes in the area, with three links carrying more than 50,000 vehicles per day.

The future design of this corridor will warrant special consideration in conjunction with the design process associated with the proposed grade separation of Dillon Road at the Southern Pacific Transportation Company railroad tracks. The accommodation of the high volume of turning movements at the intersection of Grapefruit Boulevard and Harrison Street, and at the intersection of Grapefruit Boulevard and Dillon Road, will require a design that facilitates the flow of turning vehicles on the heaviest movements. Also, to reduce the traffic demand along the Harrison Street/Grapefruit Boulevard/Dillon Road travel corridor, Avenue 50 needs to be improved between Harrison Street and the SR 86 Freeway to attract more motorists.

A second heavily used travel corridor connects Thermal Airport and the surrounding industrial areas with the SR 86 Freeway. Like the corridor between Harrison Street and the SR 86 Freeway, this travel corridor is constrained by an at grade railroad crossing and by two intersections with heavy turning movements. Some of the congested turning movements could be eliminated by providing a grade separated crossing of the railroad tracks by Tyler Street. As an alternative, a road could be constructed between Tyler Street and Avenue 52 that is west of and parallel to Grapefruit Boulevard to eliminate some of the turning movements. These issues need to be carefully evaluated in conjunction with the design of the Avenue 52 over crossing of the Southern Pacific Transportation Company railroad tracks.

The Entertainment Area, located between Interstate 10, the SR 86 Freeway and north of Avenue 50, is well situated to accommodate high traffic volumes. The Entertainment Area will be a significant traffic generator, with traffic volumes on Polk Street of 48,700 ADT to the north (near Dillon Road) and 38,800 ADT to the south (near Avenue 50).

Traffic from the McNaughton Property and the Mecca Hills area contribute to the traffic volumes on Avenue 52 (east of the SR 86 Freeway) which exceed 40,000 ADT. Similarly, traffic from the McNaughton Property, the Mecca Hills area (north of I-10), and the Entertainment Area contribute to the projected volume of 34,900 ADT on Avenue 50 (east of the SR 86 Freeway).

The Industrial Area is bounded by Grapefruit Boulevard to the west, Fillmore Street to the east, Avenue 52 to the north, and Avenue 54 to the south. A review of the daily V/C ratios and levels of service on the master planned circulation system in the vicinity of the Industrial Area (see Figure 3.5-13) indicates that it will provide adequate capacity to serve the proposed land uses. Fillmore Street will operate at LOS A and Avenue 54 will operate at LOS B or LOS C on a daily basis in the vicinity. The City should coordinate with CALTRANS to determine the likelihood of a future SR 86 Freeway interchange being added at Avenue 54 (given the possibility of a future Avenue 54 grade separation at Grapefruit Boulevard and the railroad tracks) so that sufficient right-of-way can be reserved if an interchange may be added in the future. The intersection of Fillmore Street and Airport Boulevard should be carefully designed to accommodate heavy trucks in view of its location with respect to the Industrial Area and the SR 86 interchange at Airport Boulevard.

The master planned transportation system will be adequate to ensure acceptable levels of service in the Agricultural Preserve Areas located generally south of Airport Boulevard and east of the SR 86 Freeway upon General Plan buildout. Since all of the links evaluated will operate at LOS A on a daily basis, there will be no roadway capacity constraint that forces these areas to remain agricultural lands. It is the intent of the one mile square grid system of collector streets proposed to serve agricultural truck traffic without inducing growth.

The Coachella General Plan Transportation Model included buildout of the underlying low intensity land uses within the Kohl Ranch Specific Plan site. Only a portion of the Kohl Ranch Specific Plan is located within the General Plan study area. Although the Kohl Ranch Specific Plan has not been adopted to date by Riverside County, it was addressed as Alternative 5.

Sizable residential areas exist along: Harrison Street (between Avenue 50 and Avenue 54); Avenue 52 (between Frederick Street and the SR 86 Freeway); Avenue 50 (west of Harrison Street). Timely improvements of these links to maintain adequate levels of service will be required to avoid capacity constraints which encourage through traffic to divert into adjacent residential areas. Since all of the master planned links within the planning area are projected to provide LOS D or better operation on a daily basis, a substantial amount of traffic intrusion is not expected to occur upon General Plan buildout.

The proposed General Plan includes for the downtown area: a new Avenue 50 overpass; a resident-oriented retail/commercial area within the area bounded by Harrison Street, 50th Avenue, First Street and Grapefruit Boulevard; a community-oriented mercado; residential areas consistent with proposed changes to Sixth Street; new commercial areas; and major street changes. A modified circulation plan will be developed including possible closures, re-landscaping, and privatization of the right-of-way. The daily V/C ratios and levels of service on the master planned circulation system in the vicinity of the downtown indicate that there is available capacity to accommodate changes to and intensification of the land uses in this area. The proposed modifications to the circulation plan to create a more pedestrian friendly environment will encourage the use of non-motorized transportation modes.

The General Plan addresses increased traffic volumes by assigning appropriate functional classifications for arterial streets on the Circulation Policy Diagram which will accommodate projected volumes while maintaining the City's acceptable Level of Service. In addition, the General Plan contains policies to address increased traffic volumes by requiring City review of development proposals with respect to traffic impacts, City development of necessary right-of-way and improvement standards, imposition of development fees for circulation improvements, use of transportation demand management programs and facilities to reduce traffic congestion, and the regulation of access points along arterial streets. In addition, General Plan policies indicate the City's commitment to investigate solutions to monitor and reduce future traffic congestion along the Harrison/Grapefruit/Dillon traffic corridor and the Tyler/Grapefruit/Avenue 52 traffic corridor. Because the Circulation Policy Diagram is projected to function at an acceptable level of service on all links and because General Plan policy is designed to support, implement, and fund the improvements identified on the Circulation Policy Diagram, therefore, impacts related to increased traffic volumes are not considered significant.

The Public Utilities Commission is required to establish, prior to July 1 of each year, a priority list of projects which the Commission determines to be most urgently in need of separation or alteration. To facilitate the safe and efficient movement of traffic, future grade separations and crossings along Grapefruit Boulevard and the railroad tracks at Avenue 50, Avenue 48, Avenue 52 and Avenue 54 have been identified.

Scenic corridors are linear features of the City through which people and vehicles move. They include streets, highways, and waterways with their associated pedestrian ways and bicycle trails. The General Plan contains policies which identify scenic image corridors and designate them for special treatment and improvement to highlight and improve the environmental and scenic amenities of the planning area.

Enhancement of the City's image will accrue to the treatments possible within designated image corridors throughout the City from paving, lighting and signage design to careful treatment of land use relationships and natural and man-made features visible from within the corridors. A series of specific visual and aesthetic improvements have been developed by the City of Coachella for primary and secondary image corridors. Phasing priority should be given to the primary mixed-use corridors and/or to corridors in which near-term development is expected to take place.

The ultimate circulation system is not in place at this time and will not be fully completed until local and regional growth warrant it. In general, the road network will be constructed in phases consistent with the needs of the community. The General Plan Circulation Element incorporates policies and implementation programs which encourage the orderly development and funding of the street system with priority given to funding and implementing projects which either complete links in the circulation system or relieve existing deficiencies. In addition, current City practice and General Plan policies require dedication and improvement of necessary rights-of-way along master planned streets as conditions of approval.

Alternate Transportation Modes

Rail

An integral part of the multi-modal transportation system is the provision for adequate rail service for freight hauling and, when feasible, passenger service. Although any unused capacity on the Southern Pacific railroad line between Los Angeles and Yuma, Arizona is currently being reserved for future growth in freight traffic, the potential for NAFTA funding for a second rail line could allow increased passenger rail service on the Southern Pacific mainline. The General Plan contains policies which state the City's intent to identify potential sites for a future regional multi-modal transportation facility near the Southern Pacific mainline and continue to work with appropriate agencies to plan and implement rail service between the international border crossings in Calexico and the Coachella Valley.

Airports

Thermal Airport will be faced with increasing pressure to expand its capabilities and services to meet the growing aviation demands of the region as this area continues to grow. An airport suitable for jet transportation could play an important role in the region's agriculturally-based economy by making possible shipments of high value perishable produce to major eastern markets. The Thermal Airport Master Plan identifies numerous improvements to facilitate future growth at the airport, including those following.

Stage I Thermal Airport development, includes the construction of several arterials to their ultimate arterial half-section widths, striped left-turn pockets on Airport Boulevard and Polk Street, additional instrument approaches, full-length taxiways for each runway, additional general aviation hangar positions, an additional parking apron, a 6,000 square foot general aviation terminal building, and additional general aviation automobile parking.

Forecasts of commercial service aviation demand indicate 187,000 potential enplanements for Thermal Airport for the year 2010. If/when major commercial air carrier service or cargo activity utilizing larger jet aircraft occurs at Thermal Airport major improvements will be needed including a 10,000 foot runway, a 30,000 square foot airline terminal building, additional aircraft parking ramp area and gate positions, aircraft rescue and firefighting facilities, additional air cargo ramp space and parking areas, as well as, a 20,000 square foot building. Once anticipated improvements related to commercial service activities occur, a new access for the proposed commercial service terminal will be improved from Polk Street. With long-term Thermal Airport development, Avenue 60 will need to be closed or relocated, altering the existing circulation pattern. This relocation has been incorporated into the General Plan

Circulation Policy Diagram.

To adequately address future growth at Thermal Airport, the General Plan Land Use Policy Diagram incorporates the Thermal Airport Master Plan over the airport area and includes policies which state the City's intent to work with Riverside County to implement this plan.

Public Transportation

A significant number of households within the Planning Area have no motorized form of private transportation. This portion of the population relies most heavily upon public transportation and includes: students, the elderly, the poor, and those who are disabled or ill and unable to drive. In order to accommodate alternatives to private transportation the General Plan contains policies which make public transit an integral part of Coachella's multi-modal circulation system by making it convenient and accessible to users, which require the City to coordinate with SunLine Transit to establish transit stops at high use facilities, as well as developing park and ride facilities. General Plan policy also requires dedication and or construction of appropriate facilities in support of the public transportation system and the design of noise barriers and other community perimeter walls to allow pedestrian access to bus stops.

Bicycle Facilities

Located within the City of Coachella are 3.1 miles of bike lanes (signed or striped bike lane adjacent to the street curb or striped paved shoulder) at present. The bike lanes extend along Grapefruit Boulevard (between Dillon Road and Avenue 52) and along Dillon Road (north and south of Avenue 44). The Grapefruit Boulevard bike lane is located in an arterial street corridor with a high demand for both motorized and non-motorized traffic. Dillon Road has low traffic volumes and paved shoulders that are adequate for bicyclists. The bike lane along Dillon Road extends through an undeveloped area and is heavily used for recreational cycling.

The non-motorized transportation system is intended to serve a variety of users and trip types, from school children to commuters to casual recreation users. The underlying objective is to enhance safety and enjoyment for residents and encourage the use of non-motorized transport as a viable and preferred alternative form of transportation.

The City of Coachella General Plan contains an Open Space Policy Diagram depicting the general location of bikeways until a Comprehensive Trails System Master Plan can be prepared. It includes an extensive network of bikeways that connect with proposed bikeways in surrounding areas. The proposed Circulation Element includes additional information regarding objectives and policies that the City of Coachella will adopt to encourage the use of bicycles as an alternate transportation mode. General Plan policy also requires that the Caltrans publication "Bikeway Planning and Design" be used as the standard by which bikeways are designed in the City. Caltrans standards are adhered to in most jurisdictions and make bikeway projects eligible for state funding.

Pedestrian

Pedestrian facilities are typically constructed as part of roadway construction or reconstruction activities. However, pedestrian activity zones or improvement locations may be identified at the discretion of the City. These zones or locations are areas where a package of planning, design, and operational measures may be made to make the area more pedestrian friendly. As an alternative, traffic calming techniques can be employed to reduce vehicular speeds and encourage pedestrian and other non-motorized activities.

Most pedestrian improvements will be localized closures of existing gaps in the sidewalk network, installation of crosswalks and signals, and other features such as benches. The goal is to improve pedestrian circulation and safety. The bikeway system can also accommodate pedestrian circulation on

the Class I bike paths, providing a quiet corridor to run, walk, or commute. The General Plan contains policies which encourage the development of pedestrian facilities as an alternative form of transportation.

Truck Routes

The agricultural economy of the planning area relies on the transportation system to move freight efficiently. Truck travel should be encouraged on direct routes from the industrial areas to the freeways by establishing truck routes. With the proposed industrial area adjacent to Tyler Street, Tyler Street should be designated as a truck route from Thermal Airport to Grapefruit Boulevard. All of the approaches to SR 86 Freeway interchanges should be along designated truck routes. This would include Dillon Road, Avenue 50, Avenue 52, and Airport Boulevard. With the existing designation of Harrison Street and Grapefruit Boulevard as truck routes, these streets will provide a network of streets which can be utilized by trucks as a direct path between the industrial areas and the freeways. The General Plan contains policies which state the City's commitment to designate a system of truck routes which will meet Coachella needs now and in the future.

Because the General Plan includes a planned circulation system which accommodates the targeted Level of Service and contains policies for the implementation of this system and because circulation policies also encourage the development of effective rail, air, public transit and non-motorized transportation modes, circulation impacts resulting from General Plan implementation are not considered significant.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to traffic or circulation are anticipated to result from General Plan implementation.

3.6 Air Quality

Air pollution is a major concern in southern California because of public health effects and property damage caused by air contaminants. It is also a regional problem which does not respect jurisdictional boundaries. The City of Coachella must recognize its place as both a generator and receptor of regional air pollution. The General Plan is intended to protect the health and welfare of the community by promoting development which is conducive to the attainment of state and federal ambient air quality standards. This section of the Environmental Impact Report (EIR) is based upon the "City of Coachella General Plan Update Air Quality Background Study" prepared by Endo Engineering specifically for this EIR and attached in its entirety as Appendix E.

Air Pollution Fundamentals

Air pollution is comprised of many substances generated from a variety of sources, both man-made and natural. Since the rapid industrialization of the twentieth century, almost every human endeavor, especially those relying on the burning of fossil fuels, creates air pollution. Most contaminants are actually wasted energy in the form of unburned fuels or by-products of the combustion process.

Motor vehicles are by far the most significant source of air pollutants in urban areas, emitting photochemically reactive hydrocarbons (unburned fuel), carbon monoxide, and oxides of nitrogen. These primary pollutants chemically react in the atmosphere with sunlight and the passage of time to form secondary pollutants such as ozone.

Although significant air quality improvements have been made in California over the past twenty years, Southern California still experiences severe air pollution problems. Oxidants and PM₁₀ (suspended particulate matter with a mean aerodynamic diameter of less than 10 micrometers) represent the major air quality problems in the desert regions of Southern California.

The air quality of the Coachella General Plan Update planning area is determined by the primary pollutant emissions added daily, and by the primary and secondary pollutants already present in the air mass. Primary pollutants are those emitted directly from a source and include: carbon monoxide (CO), nitric oxide (NO), sulfur dioxide (SO₂), particulates, and various hydrocarbons and other volatile organic compounds (VOC). Secondary pollutants are created with the passage of time in the air mass and include: photochemical oxidants (90% of which are ozone), photochemical aerosols, peroxyacetylnitrate (PAN), and nitrogen dioxide (NO₂). A glossary of air quality acronyms, technical terms, and phrases is included as Appendix A.

Criteria Air Pollutants

Criteria air pollutants are those air contaminants for which air quality standards currently exist. Currently, state and federal air quality standards exist for ozone, nitrogen dioxide (NO₂), sulfur dioxide (SO₂), carbon monoxide (CO), fine suspended particulates (PM₁₀), and lead. California has also set standards for visibility and sulfate. Emission levels of criteria air contaminants or their precursors typically also include total organic gases (TOG), volatile organic compounds (VOC), oxides of nitrogen (NO_x), oxides of sulfur (SO_x), and particulate matter (PM).

Carbon Monoxide (CO) is a colorless, odorless, toxic gas formed by incomplete combustion of fossil fuels. Carbon monoxide concentrations are generally higher in the winter, when meteorological conditions favor the build-up of directly emitted contaminants. Carbon monoxide health warnings and emergency episodes occur almost entirely during the winter. The most significant source of carbon monoxide is gasoline powered automobiles, as a result of inefficient fuel usage in internal combustion engines. Various industrial processes also emit carbon monoxide.

Oxides of Nitrogen (NO_x) are the primary receptors of ultraviolet light initiating the photochemical reactions that produce smog. Nitric oxide combines with oxygen in the presence of reactive hydrocarbons and sunlight to form nitrogen dioxide and ozone. Oxides of nitrogen are contributors to other air pollution problems including: high levels of fine particulate matter, poor visibility and acid deposition.

Seven oxides of nitrogen and two hydrated oxides can theoretically exist in the atmosphere, but only four are present in noticeable amounts. Two of these are classified as pollutants. These are nitric oxide (NO), a colorless, odorless gas and nitrogen dioxide (NO₂), a reddish-brown gas formed by the combination of nitric oxide with oxygen. Nitric oxide is far less toxic than nitrogen dioxide in humans.

The primary sources of nitrogen oxides in the basin are incomplete combustion in motor vehicle engines, power plants, refineries and other industrial operations. Ships, railroads and aircraft are other significant emission sources.

Sulfur Dioxide (SO₂) results from the combustion of high sulfur content fuels. Fuel combustion is the major source of SO₂, while chemical plants, sulfur recovery plants, and metal processing are minor contributors. Sulfates result from a reaction of sulfur dioxide and oxygen in the presence of sunlight. SO₂ levels are generally higher in the winter than in the summer (when sunlight is plentiful and sulfate is formed more readily).

Recent reductions in sulfur dioxide levels reflect the use of natural gas in power plants and boilers (since natural gas is very low in sulfur). Low sulfur fuel oil is also utilized within this air basin.

Hydrocarbon and other volatile organic compounds (VOC) are formed from combustion of fuels and the evaporation of organic solvents. Many hydrocarbon compounds are major air pollutants, and those classified as aromatics are highly photochemically reactive with NO_x, forming photochemical smog. Hydrocarbon concentrations are generally higher in winter when sunlight is limited and photochemical reactions occur more slowly. During the winter, meteorological conditions are more favorable to their accumulating in the atmosphere before producing photochemical oxidants. Motor vehicles are the major source of organic gases in this basin.

Particulate Matter consists of particles in the atmosphere as a by-product of fuel combustion, through abrasion such as tire wear, and through soil erosion by the wind. Particulates can also be formed through photochemical reactions in the atmosphere. PM₁₀ refers to finely divided solids or liquids such as soot, dust, and aerosols which are 10 microns or less in diameter and can enter the lungs.

About 90% of total particulates are less than 5 microns in diameter, while the aerosols formed in the atmosphere (primarily sulfate and nitrate) are usually smaller than 1 micron. Particulate concentrations are generally higher in the winter near major sources, when more fuel is burned and meteorological conditions favor the build-up of directly-emitted contaminants.

Photochemical Oxidants (O₃) can include several different pollutants, but consists primarily of ozone (90%) and a group of chemicals called organic peroxy nitrates. Ozone is a pungent, colorless toxic gas which is produced by the photochemical process. Photochemical oxidant is created by complex atmospheric reactions involving oxides of nitrogen and volatile organic compounds, in the presence of ultraviolet energy from sunlight.

Motor vehicles are the major source of ozone precursors (oxides of nitrogen and volatile organic compounds) in the air basin. Conditions throughout the basin are ideal for photochemical smog formation because of the area's dependence on the automobile. Vehicles on area roadways result in hydrocarbon and NO_x emissions that can be trapped by prevailing atmospheric inversions and exposed to sunshine.

Photochemical oxidant, characteristic of southern California smog, reaches its highest concentrations during the summer and early fall. During winter, early morning low clouds and fog prevail in urbanized coastal areas, reducing the amount of ultraviolet energy and thereby reducing the production of photochemical oxidants and the exposure of downwind receptor areas to high ozone concentrations.

Ozone is formed through chemical reactions of VOCs, oxides of nitrogen and oxygen in the presence of sunlight. Peak ozone concentrations tend to occur in the South Coast Air Basin near the middle of the day in summer and early fall, when the solar radiation exposure of the air mass is the greatest, because the reactions that form ozone begin at sunrise and require sunlight to proceed. The observed ozone concentration at a specific location is affected by the following parameters: (1) the concentrations of ozone precursors (NO_x and VOC); (2) the ratio of precursor concentrations (amount of VOC versus NO_x present, with NO_x being the critical component); (3) the spatial and temporal distribution of emissions; and (4) meteorological conditions (hot weather with lots of sunlight and strong temperature inversions).

The prevailing marine air currents throughout the SCAB typically carry polluted air inland as ozone-forming photochemical reactions proceed. That is why peak ozone concentrations in the SCAB are found in the inland valleys and adjacent mountains (between the San Fernando Valley and the Riverside-San Bernardino area), miles downwind of the largest concentrations of sources of precursor emissions. Far fewer ozone standard exceedances occur in the coastal, far inland, or desert areas than in Glendora, Fontana and Crestline.

Just as oxidant precursors from the coastal Los Angeles area aggravate oxidant problems inland in Riverside, precursor emissions from the central and eastern areas of the SCAB (including Anaheim) contribute to locally produced oxidant in the Coachella Valley.¹ A comprehensive study confirmed the transport pathways to the Coachella Valley in 1983.² Although the extent to which the intrusion of ozone contributes to Coachella Valley ozone exceedances has not been quantified, "...it is ARB's judgment that oxidant problems in the Southeast Desert would be minimal if oxidants and oxidant precursors were effectively controlled in the South Coast Air Basin."³

In the Coachella Valley, airflow is from the northwest much of the time. Peak oxidant levels occur in the late afternoon and evening (between 4 pm and 8 pm), as pollutants are blown through the San Geronio Pass. Oxidant concentrations in the Coachella Valley are highest closest to the South Coast Air Basin and decrease steadily as the air mass moves east from Banning to Palm Springs and then Coachella.

The role of local emissions in the formation of oxidants in the Coachella Valley is difficult to quantify. Locally produced oxidant undoubtedly accounts for some standard exceedances. However, tracer studies and other recent studies of ozone levels by location, hour of day, day of week, etc. indicate that an oxidant cloud caused directly by transport from the SCAB causes exceedances in Palm Springs as late as 8 pm, when local photochemical activity has slowed. In addition, transported NO_x and VOC left over from the previous day have been identified as major contributors to ozone concentrations at downwind desert locations.⁴

The air quality in the planning area is a function of the primary pollutants emitted locally, the existing regional ambient air quality, and the meteorological and topographical factors that influence the intrusion of pollutants from sources outside the immediate vicinity through the Banning Pass to the Coachella

¹ Drivas, P.J. and F.H. Shair; A Tracer Study of Pollutant Transport in the Los Angeles Area; *Atmos. Environ.* 8: 1155-1163; 1974

² Smith, T.B. et al.; *The Impact of Transport from the South Coast Air Basin on Ozone Levels in the Southeast Desert Air Basin*; CARB Research Library Report No. ARB-R-83-183.

³ SCAQMD and SCAG; *AQMP - Southeast Desert Air Basin, Riverside County*; October 1979.

⁴ SCAQMD and SCAG; *AQMP - Southeast Desert Air Basin, Riverside County*; October 1979.

Valley and into the planning area. Ozone and ozone precursors transported from the South Coast Air Basin across the mountain ranges and through the desert passes may be responsible for the occurrence of high ozone concentrations in the Coachella Valley.

There are three principle routes through the southern California mountains which border the Coachella Valley where pollutants may be transported. These mountain passes include Soledad Canyon (near Palmdale), Cajon Pass (near Victorville), and San Geronio Pass (near Palm Springs). The wind frequently flows through these mountain passes and transports photochemical smog into the Coachella Valley.⁵

Ambient Air Quality Standards

Ambient air quality is determined from data collected at air quality monitoring stations located throughout the air basin. The ambient air quality data is given in terms of state and federal standards. These standards represent air pollutant concentrations which are considered safe (with a reasonable margin of safety) to protect the public health and welfare.

Both California and the federal government have set air quality standards for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, PM10 and lead. The state and federal ambient air quality standards are detailed in the Air Quality Report in Appendix E. The California standards are more stringent than the federal standards (particularly with regard to PM10 and sulfur dioxide). California has also set standards for sulfate, visibility, hydrogen sulfide, and vinyl chloride.

Two types of national standards have been established. Primary standards were designed to safeguard the health of people considered to be sensitive receptors while outdoors were adopted. Secondary standards, designed to safeguard human welfare (by minimizing damage to plants, and the oxidation of rubber and paint etc.), were also established by the federal government.

Ambient air quality standards are designed to protect that segment of the population that is most susceptible to respiratory distress or infection such as: asthmatics, the very young, the elderly, people weak with illness or disease, or persons engaged in heavy work or exercise (i.e., sensitive receptors). Healthy adults can tolerate periodic exposures to air pollutant levels well above these standards before adverse health effects are observed.

California has adopted health advisory levels called episode criteria for ozone, carbon monoxide, sulfur dioxide, and ozone in combination with sulfates. Episode criteria represent short-term exposures at concentrations which actually threaten public health.

Episode Criteria

The most effective means of mitigating adverse impacts associated with high pollution levels is to limit the amount of pollution generated and the activity of sensitive receptors during periods when pollutant concentrations are high. Currently, the South Coast Air Quality Management District monitors contaminant levels and meteorological factors on a daily basis in order to forecast high pollutant levels in stable atmospheric conditions. Such conditions are known as "episodes". Criteria for episodes are available for photochemical oxidants, carbon monoxide, sulfur dioxide, nitrogen dioxide, particulate matter and combinations of sulfur dioxide and particulate matter. Episodes are divided into three stages depending upon the concentration of the pollutant that is predicted or reached.

⁵California Air Resources Board; *The Impact Of Transport From The South Coast Air Basin On Ozone Levels In The Southeast Desert Air Basin*; 1983.

"Good" air quality is predicted when ozone levels are predicted to remain at or below .06 ppm for one hour. "Moderate" air quality is forecast when ozone levels will meet the federal clean air standard but are predicted to be between .07 and .12 ppm. "Unhealthful" air quality is forecast when 1-hour ozone levels reach or are predicted to reach .13 or .14 ppm. This ozone level exceeds federal standards and indicates that susceptible persons should minimize outdoor activities.

An ozone health advisory is issued when 1-hour ozone levels are predicted to be between .15 ppm and .19 ppm. The issuance of an ozone health advisory indicates that susceptible persons should avoid outdoor activity and all others should avoid prolonged vigorous outdoor exercise.

"Very Unhealthful" air quality is predicted when the Stage I ozone episode levels are reached or predicted to occur (0.20 ppm for one hour). Everyone should avoid vigorous outdoor exercise when "Very Unhealthful" air quality is predicted.

"Hazardous" air quality is predicted when Stage II ozone episode levels are forecast or reached (0.35 ppm for one hour). Everyone should avoid outdoor activities and susceptible people should stay indoors when hazardous air quality is predicted.

Stage 1 Episode (Health Advisory) A health advisory is issued when the Stage 1 concentration of any pollutant is either predicted or reached. People with respiratory or coronary disease are notified through mass media to take precautions against exposure and exertion. Schools are notified through established channels so that student participation in strenuous activities is limited. Abatement actions for this stage are mainly voluntary, except for open burning of combustible refuse and the implementation of first stage-episode plans by specified industry, business and government agencies.

Stage 2 Episode (Warning) A warning must be called when Stage 2 concentrations of any pollutant are predicted or reached. Since this is an intermediate stage, abatement action to reduce emissions of the pollutant of concern can range from voluntary reduction in vehicle operations and further industrial curtailment to the mandatory prohibition of incinerator use.

Stage 3 Episode (Emergency) An emergency must be called when Stage 3 pollutant levels are predicted or reached. If local abatement efforts during a Stage 3 Episode are inadequate, the State of California can take action under the appropriate provisions of the State Peace-Time Emergency Plan. At this stage, vehicle use is prohibited and public activities can be stopped. Industrial operations may be shut down or curtailed.

Effects of Pollutants on Sensitive Receptors

The California Air Resources Board (CARB) has identified the following groups of individuals as the most likely to be affected by air pollution: the elderly over 65; children under 14; athletes; and people with cardiovascular and chronic respiratory diseases such as asthma, emphysema, and bronchitis. These sensitive groups represent over 50% of the total California population.⁶

The elderly are most sensitive, since the loss of lung tissue is a natural process of aging. Inhalation of air pollution accelerates this loss by reducing lung volume, and functional lung tissue. Damaged and irritated lung tissue becomes susceptible to bacterial infection. This increases the likelihood of chronic respiratory disease by reducing the ability of the immune system to fight infection and resist disease.

⁶ California Air Resources Board; *Facts About How Air Pollution Damages Health*; 1983.

Demonstrated effects of specific air contaminants on health and vegetation are briefly discussed below. Oxidants at high enough concentrations can cause eye irritation; aggravate respiratory disease; suppress the body's capacity to fight infection; impair athletic performance and cause growth retardation in sensitive trees. Oxidants also cause cracking of untreated rubber. Short-term and long-term ozone exposures have been found to have adverse health effects on humans and animals.

Volatile organic compounds in the presence of other primary pollutants (particularly oxides of nitrogen) lead to the formation of oxidants. VOCs also damage plants by inhibiting growth and causing flowers and leaves to fall.

Carbon monoxide is essentially colorless, odorless and toxic to humans. It enters the blood stream and interferes with the transfer of fresh oxygen, thereby depriving sensitive tissues in the heart and brain of oxygen. At high enough concentrations it can impair visual function, psychomotor performance and time discrimination. Carbon monoxide exposure aggravates angina pectoris and other aspects of coronary heart disease. It may also impose increase risks to fetuses.

Nitrogen dioxide at high enough exposures can cause fibrotic lung changes, bronchostriction, and acute bronchitis among infants and school children. Over several months, it can cause collapsed lesions near the leaf margin and moderate injury in sensitive plants. Nitrogen dioxide aggravates chronic respiratory disease and respiratory symptoms in sensitive groups.

Suspended particulates such as soot, dust, aerosols, fumes, and mists produce haze and reduce visibility. Health concerns focus on smaller particles that penetrate deeply into and then damage the human respiratory tract. Deaths from short-term exposures have been documented and symptoms are exacerbated in sensitive patients with respiratory disease. Excess seasonal declines in pulmonary function have been found (especially in children). Typically, industrial and agricultural operations, combustion, and photochemical reactions produce suspended particulates.

Lead at high enough concentrations impairs hemoglobin synthesis and nerve conduction by increasing lead levels in the blood. Sulfur dioxide and suspended particulate exposures can each cause higher frequencies of acute respiratory symptoms and diminished ventilatory function in children. In addition, these two pollutants at lower concentrations can act in conjunction to cause greater harm by injuring lung tissue. Sulfur oxides, in combinations with moisture and oxygen, can yellow the leaves of plants, dissolve marble, and erode iron and steel. Sulfates decrease ventilatory function, aggravate asthmatic symptoms, aggravate cardio-pulmonary disease and cause damage to vegetation (while degrading visibility).

Existing Conditions

Regional Air Quality

State and federal legislation mandating regional plans to improve air quality to healthful levels has resulted from concerns over air pollutant problems. Both the Southern California Association of Governments (SCAG) and the South Coast Air Quality Management District (SCAQMD) are responsible for preparing an Air Quality Management Plan (AQMP) for the 12,000 ± square mile South Coast Air Basin (SCAB) and the Los Angeles County and Riverside County portions of what used to be, under state classification, the South East Desert Air Basin (SEDAB).

In May of 1996, the boundaries of the SCAB were changed by the California Air Resources Board (CARB) to include the Beaumont-Banning area. At that time, the SEDAB was separated into two areas that were renamed the Mojave Desert Air Basin and the Salton Sea Air Basin. The City of Coachella is located within the Salton Sea Air Basin (SSAB). The Salton Sea Air Basin portion of Riverside

County east of the SCAB (referred to in the 1994 Air Quality Management Plan as the "Coachella Valley Planning Area") is bounded by the San Jacinto Mountains (to the west) and the eastern boundary of the Coachella Valley (to the east).⁷

Regional Climate and Meteorology

The extent and severity of the air pollution problem in the SCAB is a function of its natural physical characteristics (weather and topography) as well as man-made influences (development patterns and lifestyle). Factors such as wind, sunlight, temperature, humidity, rainfall and topography all affect the accumulation and dispersion of pollutants throughout the basin. The interrelationships of these variables with the type and location of pollution generated in the basin are complex and variable.

The SCAB is comprised of a coastal plain with connecting broad valleys and hills that is bounded by the mountains and the Pacific Ocean. It lies in the semi-permanent high pressure zone of the eastern Pacific. The climate is controlled largely by the strength and location of the sub-tropical high pressure cell over the Pacific Ocean. The region has a Mediterranean climate with moderate temperatures (warm summers and mild winters), comfortable humidities, and precipitation limited to the short winter "rainy" season.

The land/sea breeze is the primary factor affecting the region's mild climate. The daytime winds are predominantly onshore sea breezes from the northwest which flow at relatively low velocities. The sea breezes exhibit velocities below 15 miles per hour (mph) approximately 96 percent of the time, and below 4 mph about half of the time, with an average velocity of 5 to 7 mph. During the night, the winds usually slow and reverse direction, traveling toward the sea. These land breezes flow from the southeast at 1 to 2 miles per hour.⁸

During the fall and winter months the basin is subject to moderate and strong Santa Ana winds. These dry warm northerly and northeasterly winds typically last for several days and exhibit velocities which exceed 40 mph at times.

During the spring and early summer, most of the air pollutants emitted daily are moved out of the basin through mountain passes, or lifted by warm vertical air currents produced by the heating of mountain slopes. In this manner, the basin is cleansed by the natural transport of ocean air inland. However, between June and September, lighter wind speeds, a shallow vertical mixing layer, and the earlier appearance of off-shore drainage winds all combine to reduce the dispersion of air pollution vertically and horizontally.

Throughout the SCAB, the vertical dispersion of air pollutants is restricted by the presence of a persistent temperature inversion near the surface (when temperature increases with altitude) that reduces the mixing height. Elevated inversions restrict vertical mixing and trap air pollutants within the mixing layer above the basin. On hot summer days, the inversion layer often remains, trapping pollutants in a limited mixing area until middle or late afternoon (when the inversion layer lifts, erodes, or surface winds are sufficient to disperse the pollutants horizontally). These inversions are partially responsible for the high concentrations of ozone that occur during summer months in the air basin.

Ground-based radiation inversions are more severe during clear cold early winter mornings. When ground based inversions persist, very little mixing or turbulence occurs and high concentrations of primary pollutants result near roadways and other pollutant sources. Winter inversions frequently weaken and erode by mid-morning, thereby preventing the accumulation of contaminants.

⁷ Although the state redrew the boundaries of the desert regions of Southern California, the federal ozone nonattainment area is still called the Southeast Desert Modified Ozone Nonattainment Area.

⁸ SCAQMD, *Air Quality Handbook*; April 1987.

Regional Ambient Air Quality

Southern California, with the lowest summertime mean mixing height, the lowest average wind speed and emissions from the second largest urban area in the U.S., has the worst air pollution problem in the nation. Although past programs have been effective at improving the air quality of the SCAB, it still exceeds health-based standards for ozone, carbon monoxide and PM₁₀. Ozone levels have been reduced by 50 percent over the last 30 years, sulfur dioxide and lead standards have been met, and other criteria pollutant concentrations have significantly declined. The Basin met the federal annual NO₂ standard for the first time in 1992.

Local Air Quality

Local Climate and Meteorology

The planning area is located in the Coachella Valley, an arid desert region with a climate characterized by low annual rainfall, low humidity, hot days and very cool nights. The climatological station closest to the project site is located at Thermal Airport.

The annual precipitation monitored during 1995 at Thermal Airport was 3.11 inches, which was 0.05 inches below the average annual rainfall total normalized over the past 47 years. The monthly average temperature ranged from a low of 54.5 degrees Fahrenheit during January to a high of 92.2 degrees Fahrenheit in August. Temperature extremes ranged from 28 to 126 degrees Fahrenheit.⁹

Wind direction and speed (which in turn affect atmospheric stability) are the most important climatological elements affecting ambient air quality within the planning area. The prevailing wind direction at Thermal Airport is predominantly from the northwest. The annual mean wind speed is 8.1 miles per hour. Calm conditions occur 2.0 percent of the time at Thermal Airport.

Since the dominant daytime onshore wind pattern follows the peak travel period (6:00 am - 9:00 am) in the Los Angeles/Orange County area, during periods of low inversions and low wind speeds, the photochemical smog formed in these areas is transported downwind into Riverside County, San Bernardino County and the Coachella Valley.

Peak oxidant levels occur in the late afternoon and evening (between 4 pm and 8 pm), as pollutants are blown through the San Geronimo Pass. Oxidant concentrations in the 50-mile long and 20-mile wide Coachella Valley are highest, closest to the South Coast Air Basin, and decrease steadily as the air mass moves east from Banning to Palm Springs and then Indio.

The mountain ranges to the west (San Jacinto and Santa Rosa) and to the north (San Bernardino) form a physical and climatological barrier between the Southeast Desert Air Basin and the South Coast Air Basin. Thus, inversion conditions are less favorable in the planning area than in the coastal areas of Southern California.

Inversion conditions are associated with degraded air quality because the surface air is prevented from rising and dissipating the air pollutants that accumulate throughout the day. Surface-based inversions in the Coachella Valley are prevalent at night throughout the year and usually persist into the day during the winter months.

Four key elements are required to specify the meteorological conditions affecting the transport and dispersion of air pollutants. These include the wind direction, wind speed, atmospheric stability, and mixing height. Although regional meteorological conditions (such as temperature inversions, Santa Ana

⁹ NOAA; *Climatological Data Annual Summary*, 1995.

wind conditions, etc.) will dominate local conditions, wind direction, wind speed, and localized turbulence generated by local topographical conditions can play a key role in determining the ambient air quality within the planning area.

Desert regions are generally windy because minimal friction is generated between the moving air and the low, sparse vegetation. This allows the wind to maintain its speed crossing the desert plains. In addition, the rapid daytime heating of the air closest to the desert surface leads to convective activity and the exchange of surface air for upper air which accelerates surface winds during the warm part of the day. Rapid cooling at night in the surface layers during the winter months results in a high frequency of calm winds.¹⁰

Radiation inversions are prevalent at night throughout the year. They limit the mixing in the lower atmosphere to a height of 200 to 2,000 feet. They persist through much of the day in winter but are destroyed early in the day in summer.

Local Ambient Air Quality

The South Coast Air Quality Management District maintains ambient air quality monitoring stations at numerous locations throughout the basin (see Figure 2-1). The project site is located within Source Receptor Area (SRA) 30. The SRA 30 monitoring stations are located in the City of Palm Springs and the City of Indio. The 1993 through 1995 ambient air quality data (which is included in Appendix E) indicates that only ozone and PM10 have exceeded the relevant state and federal standards.

Ozone - The City of Coachella is located within the Coachella Valley, an area which often receives pollutant transport from the South Coast Air Basin. Poor ozone air quality in this area is due primarily to transport of both ozone and its precursor emissions from the upwind source region of the South Coast Air Basin.

Ozone air quality trends since 1976 for the South Air Basin and the Coachella-San Jacinto Planning Area indicate a parallel downward trend in the number of days exceeding the federal 1-hour ozone standard, despite the fact that population growth in the Coachella-San Jacinto Planning Area was much greater than in the South Coast Air Basin. Between 1980 and 1990, the population grew in the South Coast Air Basin by an average of 2.2 percent per year, compared to a 5.2 percent per year population growth rate in the Coachella-San Jacinto Planning Area.¹¹

The number of days per month exceeding the federal one-hour ozone standard and the number of months in which exceedances have been observed have dropped dramatically between 1980 and 1995. This has occurred despite the fact that population growth in the Coachella Valley over this period has been dramatic. The 1997 AQMP indicates that this trend has been the result of the SCAQMD's control strategy for the SCAB.

The Coachella Valley is currently designated as a "severe-17" ozone nonattainment area. This designation indicates that the attainment date for the federal ozone standards is November 15, 2007 (17 years from the date of enactment of the federal Clean Air Act). The 1994 AQMP indicated that attainment of the standard is possible with the proposed control strategy for the SCAB and control of locally generated emissions via state and federal regulations. The 1997 AQMP carries forward the 1994 AQMP control approach for the Coachella Valley.

¹⁰ California Air Resources Board; *Climate of the Southeast Desert Air Basin*, January, 1990.

¹¹ SCAQMD; 1994 AQMP Appendix I-B *Air Quality Management Plan for the Coachella-San Jacinto Planning Area*; May 1994.

Ozone levels exceeded the state one-hour standard (0.09 ppm) on 18 percent of the days monitored. The maximum one-hour ozone concentration measured was 0.17 parts per million (ppm) between 1993 and 1995. This exceeds the federal standard by more than 40 percent and is nearly twice the level set as the state standard. The federal one-hour ozone standard (>.12 ppm) was exceeded on four percent of the days monitored. No ozone episodes were declared at either air monitoring station during the past three years.

Inhalable Particulate Matter (PM₁₀) - The Coachella Valley was reclassified in February 1993 by the Environmental Protection Agency (EPA) as a "serious" nonattainment area for PM₁₀, which means that the valley had violated federal health-based standards for particulate matter. PM₁₀ in this area comes mostly from locally generated fugitive dust produced by both human activities (on-road and off-road vehicles and construction activities) and natural occurrences (wind storms). The highest concentrations are found in the summer, when hot dry weather produces more dust. A PM₁₀ maintenance plan for the Coachella Valley is currently being developed as a separate plan from the 1997 AQMP.

PM₁₀ monitoring in the Coachella Valley over the last three years indicates that (with the exception of one measured PM₁₀ exceedance due to a high wind natural event) the area has attained the federal PM₁₀ standard. The EPA recently released a natural events policy which exempts certain high wind events causing PM₁₀ air quality exceedances as being counted as a violation. Consequently, the Coachella Valley is now eligible for consideration by the EPA as having attained the federal PM₁₀ standard.

PM₁₀ concentrations exceeded the California 24-hour standard during 41 percent of the monitoring periods (27 sampling periods). The maximum 24-hour PM₁₀ concentration monitored was 199 micrograms per cubic meter (nearly four times the state standard of 50 micrograms per cubic meter). The annual geometric mean concentration exceeded the state standard of 30 micrograms per cubic meter during all three years, 1993-1995, and ranged between 40.6 and 47.2 micrograms per cubic meter in the Coachella Valley.

The federal 24-hour PM₁₀ standard of 150 ug/m³ was exceeded only once between 1993 and 1995 (during 1995) when the PM₁₀ concentration reached 199 ug/m³. The annual arithmetic mean was 52.0 ug/m³ during 1995, which exceeded the federal standard of 50 ug/m³.

In addition to the air quality data provided by the local air monitoring stations, the SCAQMD has estimated the amount and source of "fugitive dust" PM₁₀ emissions. Fugitive dust is particulate matter emitted from an open "area source" such as: agricultural tilling; building construction activity; and vehicular traffic on paved and unpaved roads. Sources of particulate matter such as manufacturing, mineral processing and electric power generation are "ducted sources" involving air quality equipment that is issued permits by the SCAQMD rather than "area sources".

Table 3.6-1 below characterizes the open sources of fugitive dust PM₁₀ emissions throughout Riverside County in 1987 and in the year 2010. Although natural/unspecified sources comprised over 65 percent of the open area source PM₁₀ emissions in 1987 (followed by paved roads at 14 percent, and construction at 10 percent), by the year 2010, this situation is projected to change dramatically and the primary open area source category is projected to be construction (at more than 59 percent).

Nitrogen Dioxide - The federal annual average nitrogen dioxide standard was not exceeded at the Coachella Valley stations between 1993 and 1995. Similarly, the state 1-hour nitrogen dioxide standard was not exceeded. The maximum 1-hour NO₂ concentration monitored was 0.15 ppm, which was 60 percent of the standard (0.25 ppm).

Carbon Monoxide - The state and national carbon monoxide (CO) standards were not exceeded in the Coachella Valley between 1993 and 1995. The highest maximum CO concentration measured during the last three years was 6.0 ppm (1-hour average) and 2.0 ppm (8-hour average).

**Table 3.6-1
PM10 Area Source Emissions*
Riverside County - SEDAB**

Source Category	Baseline Year 1987 (Tons/Day)	Year 2010 (Tons/Day)
Farming Operations	0.3	0.5
Construction	12.1	157.4
Paved Roads	16.1	5.2
Unpaved Roads	9.0	18.7
Waste Disposal	2.7	7.2
Natural/Unspecified	77.8	77.8
Total	118.0	266.8

a. SCAQMD, AQMP Draft Technical Report III-F Inventory of PM10 Emission, December 1990.

Other Criteria Pollutants -Sulfur dioxide and lead are not monitored in the Coachella Valley. Lead concentrations dropped dramatically following the phasing out of leaded gasoline. Federal sulfur dioxide standards were last exceeded in the 1960's and the state standards were last exceeded in 1990 in Los Angeles County. These pollutants are not of concern to the SCAQMD or the California Air Resources Board (CARB) in the Coachella Valley.

Existing Sensitive Receptors

Land uses considered by the SCAQMD to be sensitive receptors include the following:

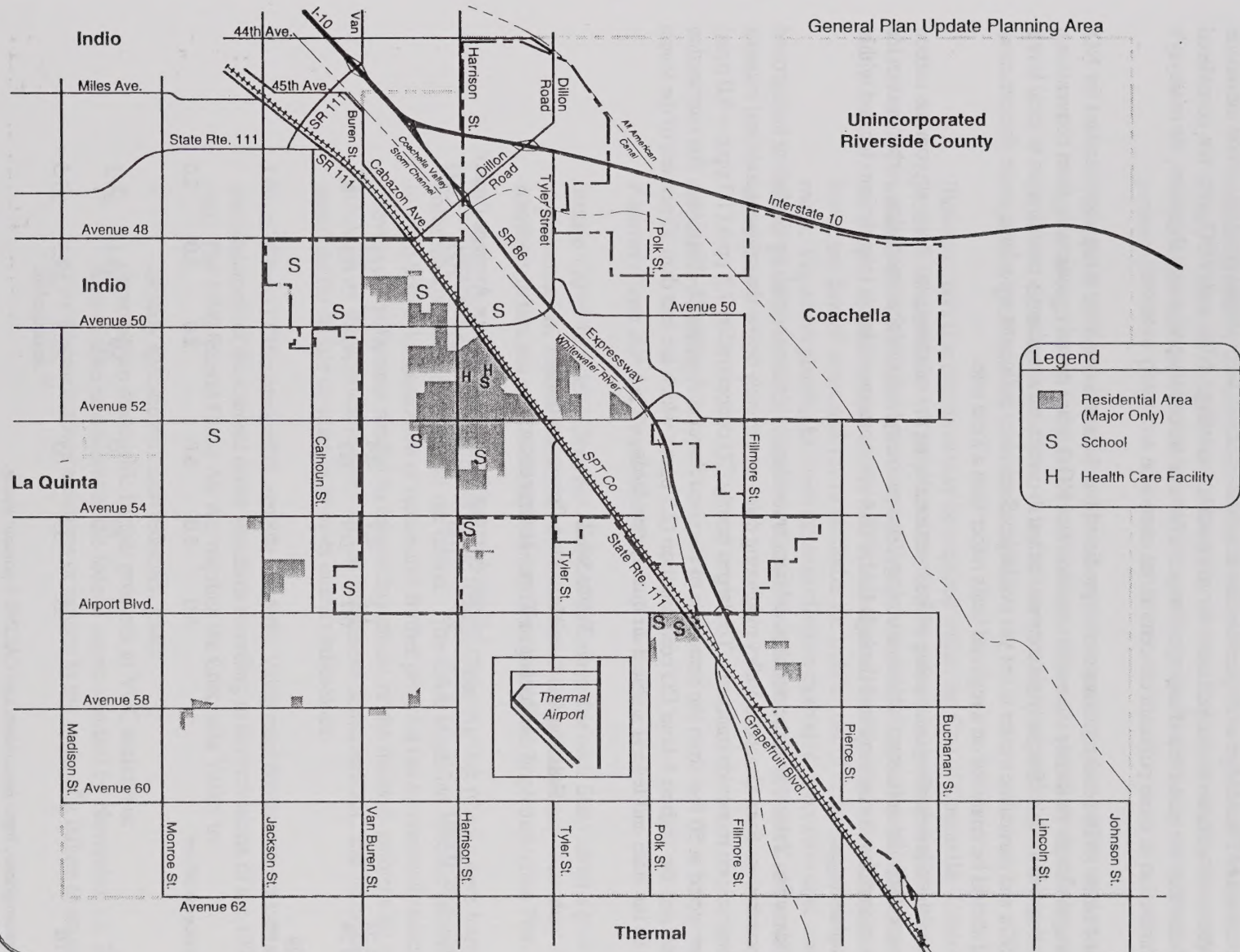
- residences,
- schools,
- playgrounds,
- child care centers,
- athletic facilities.
- long-term health care facilities,
- rehabilitation centers,
- convalescent centers,
- retirement homes, and

If these receptors are located adjacent to a freeway or major intersection, carbon monoxide (CO) "hot spots" may occur during times of peak use. High levels of carbon monoxide are also associated with traffic congestion, and with idling or slow-moving vehicles, depending on the background CO concentration. Therefore, projects that could negatively impact levels of service at major intersections with nearby sensitive receptors must quantify and, if necessary, mitigate potential impacts.

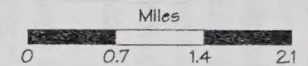
Figure 3.6-1 identifies and locates the receptors that are sensitive to air quality within the planning area. Residential development exists adjacent to the intersection of Harrison Street and Avenue 52, and a school is located at the intersection of Harrison Street and Avenue 54. To evaluate the potential for a CO "hot spot" at these two intersections that could affect pedestrians, they were modeled with the California Line Source Dispersion Model (CALINE 4) developed by Caltrans, as discussed below. The intersection of Avenue 52 and the SR 86 Expressway was also modeled in an effort to evaluate a "worst case" situation (where traffic demands are expected to increase dramatically in the future).

Local Sources of Air Contaminants

The Coachella Valley is sparsely populated, with the largest urban area represented by Palm Springs. Industrial sources in the Coachella Valley are generally limited and localized.



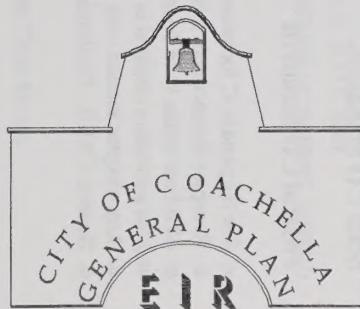
Source: Endo Engineering



Existing Sensitive Air Quality Receptors

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Figure No. 3.6-1



Existing Carbon Monoxide Concentrations

Because of the relative inertness of carbon monoxide in the photochemical smog formation process (and limitations of knowledge on dispersion characteristics of other air pollutant species) carbon monoxide is the most suitable tracer pollutant for microscale modeling. NO_x and VOC were not considered because they are unstable and undergo changes to become secondary pollutants; therefore, the roadway's contribution to these pollutant concentrations cannot be accurately assessed.

Nitric oxide (NO) concentrations can be predicted but there is no ambient air quality standard for NO. Nitrogen dioxide (which is the major constituent of NO_x) is not directly predictable from conventional non-reactive models. Similarly, an accurate method to determine a roadway's contribution to local levels of SO_x and particulate matter is not yet available. Secondary pollutants are a large-scale phenomenon, and should be analyzed on a regional basis rather than a local one.

Given the number of vehicles using an intersection during the morning peak hour, appropriate carbon monoxide emission factors, local meteorology, site geometry and site characteristics, carbon monoxide concentrations can be projected through CALINE 4 computer modeling at intersections located within the planning area.

As shown in Table 3.6-2, the modeled 1-hour carbon monoxide concentrations (including background concentrations from Coachella Valley monitoring data) are currently below the relevant state and national 1-hour carbon monoxide standards. The largest hourly CO concentration 7.3 ppm (1.3 ppm + 6.0 ppm) is expected at 50 feet from the centerline of Harrison Street at Avenue 52. Similarly, this intersection generates the highest 8-hour CO concentration (2.7 ppm), which are less than 30 percent of the levels set as the state and federal ambient air quality standards.

Table 3.6-2
Existing Carbon Monoxide Concentrations*
Adjacent to Three Intersections

Receptor Distances ^b (Feet)	1-Hour Average (ppm)			8-Hour Average (ppm) ^c		
	50 ^d	100	200	50 ^d	100	200
Harrison Street @						
- Avenue 52	1.3	0.7	0.4	0.7	0.4	0.2
- Avenue 54	0.7	0.4	0.3	0.4	0.2	0.2
SR 86 Expressway @						
- Avenue 52	0.5	0.3	0.2	0.3	0.2	0.1
Background CO Concentration*	6.0	6.0	6.0	2.0	2.0	2.0
State CO Standard	20	20	20	≥9.1	≥9.1	≥9.1
Federal CO Standard	35	35	35	≥9.5	≥9.5	≥9.5

a. See Appendix C for assumptions, input parameters, and CALINE 4 printout sheets.

b. Receptor distances are measured from the roadway centerline.

c. All 8-hour values were determined by assuming a persistence factor of 0.50 which was derived from CO measurements in the Coachella Valley and the procedure outlined in the CEQA Air Quality Handbook, as shown in the Rollback Emission Levels worksheet in Appendix C.

d. Any receptor located only 50 feet from the centerline may be located within the roadway right-of-way.

e. Source: CARB, "California Air Quality Data", highest measured value between 1993 and 1995 at the Coachella Valley monitoring stations.

Blowsand Hazard

As shown in Figure 3.6-2, (Coachella Valley Blowsand Region) only the northernmost tip of the planning area (north of Interstate 10 on either side of Harrison Street) appears to be located within the area designated by the Coachella Valley Association of Governments (CVAG) as a "Blowsand Hazard Zone".¹² This zone is defined as "... all land, by nature of its location or soil characteristics subject to real or potential sand accumulation and/or abrasion, or land which may cause sand damage to adjacent property."

Blowsand is the most severe form of wind erosion, occurring when barren sand or sandy loam soils are exposed to high winds, in the absence of moisture. Blowsand can cause significant property damage and expensive clean-up procedures. It contributes to high suspended particulate levels and associated respiratory problems for sensitive receptors.

Blowsand reduction measures may be required within the City of Coachella. Controlling the blowsand problem is intended: (1) to protect the health, safety and general welfare of any current or future residents of the blowsand hazard zone; (2) to provide for the protection of adjacent property owners who are subject to soil erosion and/or soil accumulation resulting from development activities within the blowsand hazard zone; and (3) to minimize the public cost of removing accumulated sand on public roads. Vegetative planting has been the most effective method of direct blowsand control and protection. Other possible methods include: walls, screens, fences, ground covers, soil stabilizers, and watering techniques.

Regulatory Setting

Federal Clean Air Act Requirements

Section 110 of the federal Clean Air Act (CAA) requires that each State adopt a plan which provides for implementation, maintenance and enforcement of the primary and secondary national air quality standards in that state. That requirement is met by the State Implementation Plan (SIP).

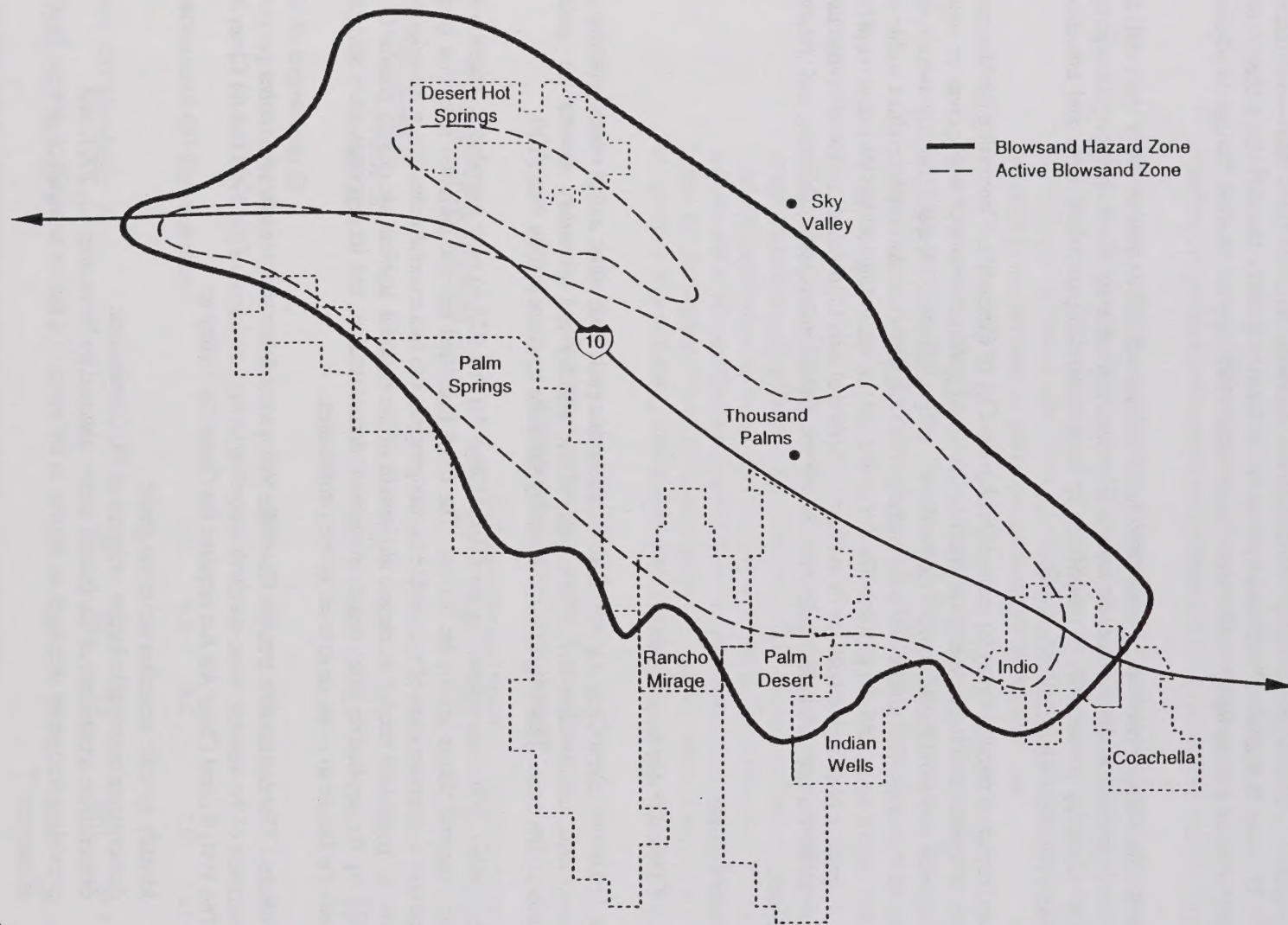
The November 1990 amendments to the federal Clean Air Act (CAA) were intended to intensify air pollution control efforts across the nation. The CAA identified specific emission reduction goals, required both a demonstration of reasonable further progress (an incremental reduction in emissions of relevant air pollutants needed to ensure attainment of the national ambient air quality standards or NAAQS by the applicable date) and an attainment demonstration, and incorporates more stringent sanctions for failure to attain or to meet interim milestones.

As a "severe-17" nonattainment area, the Coachella Valley must demonstrate reasonable further progress and attainment of the national ozone standards according to the provisions of the 1990 federal Clean Air Act. The 1990 federal Clean Air Act requires the Coachella Valley to:

- identify specific emission reduction goals;
- demonstrate reasonable further progress in VOC emissions;
- demonstrate attainment of the federal ozone standard by November 15, 2007; and
- provide contingency measures or actions in the event of a failure to attain or to meet interim milestones.¹³

¹² CVAG; *Final SIP for PM10 in the Coachella Valley*; November 1990.

¹³ The 1997 AQMP revision addresses these requirements and satisfies the SIP requirements under Title I of the Clean Air Act.



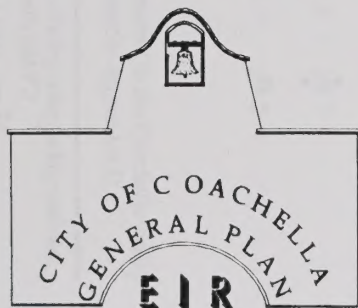
Source: Endo Engineering

Derived from C.V.A.G. Blowsand Control and Protection Plan, June 1977

Coachella Valley Blowsand Region

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Figure No. 3.6-2



The CAA also requires that each serious ozone nonattainment area achieve actual VOC emission reductions of at least 3% per year (averaged over each consecutive 3-year period beginning November 15, 1997 until November 15, 2007). Milestone years for VOC emission reductions in the Coachella Valley are 1999, 2002, 2005 and 2007.

This requirement appears to be extremely difficult to meet in the Coachella Valley because of the limited local emissions in the area in 1990 and the rapid population growth projected for this area. All increases in VOC emissions caused by growth will need to be fully offset in order to meet both the federal Clean Air Act and the California Clean Air Act requirements. For example, the CAA requires 3% VOC emission reductions beginning in 1997. If an area experiences population growth such that VOC emissions increase by 15% over 1990 levels, then the area must develop regulations that achieve VOC reductions of at least 18% (the 3% rate-of-progress requirement plus the 15% increase from population growth). According to the Southern California Association of Governments, by the year 2020, population in the Coachella Valley is projected to more than double (from 267,000 in 1990 to 389,000 in the year 2010 and 475,000 in the year 2020). In view of the population growth projected for the Coachella Valley, the rate-of-progress requirements of the CAA cannot be met unless further local controls are implemented.¹⁴

In view of strong evidence that pollutant transport from the SCAB to the Coachella Valley is the primary cause of the ozone nonattainment status of the Coachella Valley, the 1997 AQMP states that aggressive control of the SCAB emissions is an effective strategy to substantially improve air quality in the Coachella Valley.

The Coachella-Valley is currently designated as a "severe-17" ozone nonattainment area. This designation indicates that the attainment date for the federal ozone standards is November 15, 2007 (17 years from the date of enactment of the federal Clean Air Act). The 1994 AQMP indicated that attainment of the standard would be possible with the proposed control strategy for the SCAB and control of locally generated emissions via state and federal regulations. The 1997 AQMP photochemical grid modeling carries forward the 1994 AQMP conclusions and control approach for the Coachella Valley.

The 1997 AQMP demonstrates that the VOC and NOx emission reductions from existing SCAQMD and CARB rules are sufficient to meet the CAA post-1996 rate-of-progress requirements for the Coachella Valley.¹⁵ The rate-of-progress requirements for all milestone years are met by a combination of VOC and NOx reduction from existing SCAQMD and ARB rules. The control strategy provides additional VOC and NOx reductions for all the years beginning with 1999 which can be used as a contingency in the event of a milestone failure.

The CAA requires the SCAQMD to develop: a Federal Attainment Plan for Ozone; a post-1996 rate-of-progress demonstration; an ozone attainment demonstration; a PM10 SIP which incorporates best available control measures (BACM) for fugitive sources; near-term (<year 2000) and long-term (>year 2000) transportation control measures and contingency measures (i.e., additional control measures which would be implemented in the event of a milestone or attainment failure).

The California Clean Air Act

The California Clean Air Act (CCAA), which is generally more stringent than the federal CAA, was signed into law in 1988 and amended in 1992. The CCAA divides nonattainment areas into categories with progressively more stringent requirements, based on pollutant levels monitored therein.

¹⁴ SCAQMD; *Draft 1997 AQMP*; August 1996; Table 8-1.

¹⁵ SCAQMD; *Draft 1997 AQMP*; August 1996; Table 8-4.

The CCAA establishes a legal mandate to achieve health-based state air quality standards at the earliest practicable date that is generally more stringent than the federal CAA. Serious and above nonattainment areas are required to revise their AQMP to include specified emission reduction strategies and to meet milestones in implementing emission controls and achieving better air quality.

The Coachella General Plan Update planning area is located in the Coachella Valley, which is an extreme nonattainment area for ozone (based upon the state 1-hour ozone standard). The ozone standard exceedance is attributed to pollutant transport from the South Coast Air Basin (SCAB). Since the SCAB is a non-attainment area for carbon monoxide, nitrogen dioxide, ozone and PM₁₀, the Coachella Valley may only be able to attain the ozone standard after the SCAB reduces emissions of ozone precursors (VOCs and NO_x).

The CCAA requires the establishment of indirect and area source controls to reduce vehicle miles traveled (VMT) and increase average vehicle ridership (AVR). It specifies the use of best available retrofit control technology for existing sources. The CCAA requires new source review to mitigate all emissions from new and modified permitted sources. It also requires consideration of transportation control measures (TCM's) and significant use of low-emission vehicles by fleet operators.

CCAA requirements for control strategy development that are addressed in the 1997 AQMP (Revised October 1996) include:

- Rate-of-progress requirements (reducing pollutants contributing to nonattainment by 5% per year or the maximum feasible);
- Reduce per-capita population exposure to severe nonattainment pollutants (Ozone, CO and NO₂ for the SCAB) according to a prescribed schedule;
- Rank control measures by cost-effectiveness and implementation priority.

Air Quality Management Plan

It is the responsibility of the South Coast Air Quality Management District (SCAQMD) to lead the regional effort to attain the state and national AAQS. The SCAQMD is charged with developing and implementing the *Air Quality Management Plan* and reducing emissions from industries, some mobile sources, and consumer products. The state Clean Air Act requires that the AQMP be updated every 3 years.

The *Air Quality Management Plan* (AQMP) for the SCAB was originally adopted in 1979. Subsequent revisions, as required by both state and federal Clean Air Acts, have occurred since that time. The purpose of the 1994 AQMP was to set forth a comprehensive program to lead the SCAB and Southeast Desert Air Basin portions of Los Angeles and Riverside Counties into compliance with all national and state air quality standards.

The 1994 AQMP addressed the following federal Clean Air Act requirements for all nonattainment areas within the SCAQMD's jurisdiction:¹⁶

- updated 1990 emission inventories for CO, VOC, NO_x, SO_x and PM₁₀;
- revised demonstration of 15% reduction in VOC emissions by 1996 to meet rate-of-progress requirements;
- post-1996 VOC rate-of-progress requirements;
- an overall control strategy that met federal Reasonably Available Control Measures (RACM) and Reasonably Available Control Technology (RACT) requirements;

¹⁶The SCAB and those portions of the Southeast Desert Nonattainment Area (Antelope Valley and Coachella-San Jacinto Planning Area) are nonattainment areas within the SCAQMD's jurisdiction.

- Transportation Control Measures;
- attainment demonstration for ozone including contingency measures;
- revised attainment demonstrations for CO and NO₂ including contingency measures; and
- Best Available Control Measures for PM₁₀.

The 1994 AQMP demonstrated attainment of the federal and state ambient air quality standards. It proposed to achieve the federal ozone and PM₁₀ standards through long-term measures that emphasized a greater reduction of nitrogen oxides emissions from on-road and off-road sources than previous versions of the AQMP.

The 1994 AQMP addressed the State Implementation Plan requirements under Title I of the federal Clean Air Act while acknowledging that attainment of the national ozone standard in the Coachella-San Jacinto Planning Area would only be possible with substantial emission reductions in the South Coast Air Basin. The 1994 AQMP proposed an aggressive control strategy for VOC and NO_x emission sources in the South Coast Air Basin as well as control of locally generated emissions via proposed control measures implemented by state and federal actions. The 1994 AQMP concluded that: (1) a control strategy that concentrates on South Coast Air Basin sources is sufficient to demonstrate attainment in the Coachella-San Jacinto Planning Area; and (2) control of local VOC and NO_x emissions will have little effect on ozone exceedances in the planning area.

A comparison of the 1993, year 2010 and year 2020 emission inventory forecasts for the South Coast Air Basin and the Coachella Valley (Table 3.6-3) reveals why aggressive control of VOC and NO_x emissions within the South Coast Air Basin is the most effective control strategy for ozone attainment in the Coachella Valley. Locally generated emissions are overwhelmed by upwind emissions generated within the South Coast Air Basin. The South Coast Air Basin emissions of VOC and NO_x are up to 50 times those in the Coachella Valley. Improved air quality in the Coachella Valley clearly depends on reduced emissions in the South Coast Air Basin.

Table 3.6-3
Regional Emission Inventory Comparison

Area	Average Annual Daily Emission Rate (Tons/Day)				
	CO	VOC	NO _x	SO _x	PM ₁₀
1993 Forecast					
South Coast Air Basin ^a	7,045	1,239	1,194	79	416
Coachella Valley ^a	270	40	54	1	88
2010 Forecast					
South Coast Air Basin ^b	3,341	769	697	70	457
2020 Forecast					
South Coast Air Basin ^c	3,350	819	718	80	475

a. SCAQMD; 1997 *Air Quality Management Plan*; Revised October 1996; Table 8-2 page 8-7.

b. SCAQMD; 1997 AQMP Appendix III; Revised October 1996; Table A-13, page III-A-39.

c. SCAQMD; 1997 AQMP Appendix III; Revised October 1996; Table A-14, page III-A-42.

Photochemical modeling undertaken by the SCAQMD for the 1994 AQMP has demonstrated that the federal one-hour ozone standard will be met by November 15, 2007 in the Coachella-San Jacinto Planning Area, as required by the federal Clean Air Act. The AQMP control strategy provides sufficient VOC and NOx emission reductions from existing SCAQMD and ARB rules to meet the CAA rate-of-progress requirements for the Coachella Valley.

Because local government provides the primary focus of land use and growth management decisions, no air quality management plan can succeed without the active participation of local government. Most of the control measures relating to local government are in the areas of trip reduction, energy conservation, and dust control.

Consistent with the need to reduce emissions from mobile sources, many control measures identified focus on alternatives to current transportation strategies. Ridesharing, carpooling, flexible work schedules, parking management and the acquisition of clean-fueled fleet vehicles are a few of the transportation control measures to be considered for adoption by the City of Coachella. Also included are measures which call upon local jurisdictions to develop more efficient management programs for solid waste including: (1) recycling programs; (2) energy conservation programs; and (3) programs to reduce fugitive dust emissions. Nearly all of the measures call for the adoption of ordinances within the next five years to implement control programs.

The AQMP control measures will reduce emissions by:

- Maximizing reductions in the use of pollutant-emitting materials;
- Maximizing the substitution of non-polluting or less-polluting materials;
- Maximizing the use of the most efficient pollution control devices;
- Maximizing the compliance and maintenance programs for fugitive dust emissions;
- Maximizing the efficiency of the transportation infrastructure to provide less polluting forms of transportation;
- Maximizing the effectiveness of existing measures through improved administrative practices; and
- Maximizing strong public and private commitments for the required implementation actions.

State Implementation Plan for PM₁₀ in the Coachella Valley

The SCAQMD's *Final November 1990 State Implementation Plan (SIP) for PM₁₀ in the Coachella Valley* addresses the EPA's non-attainment particulate designation for the Coachella Valley and the control measures required to meet state and federal PM₁₀ standards (50 ug/m³ annual average and 150 ug/m³ 24-hour average, respectively) by 1995, as shown in Appendix E. Large-scale blowsand events, which can produce high levels of PM₁₀ through natural processes, are not targeted for control. This SIP focuses on man-made dust producing activities and the reduction of blowsand intrusion into populated areas.

The implementation and monitoring program of the SIP is dependent on the SCAQMD, CVAG and local governments. Local governments (e.g. the City of Coachella) are asked to develop ordinances, monitor progress, and create a County Service Area (CSA) or similar funding mechanism to implement the SIP. Specific actions that local governments will implement are summarized as follows:

- Include PM₁₀ analysis and mitigation measures in the CEQA review for new projects;
- Adopt an ordinance addressing emissions from construction activities;
- Adopt an ordinance specifying supplemental development standards for new and existing uses;
- Initiate a clean streets management program;

- Initiate a tree (windbreaks) planting program;
- Adopt an ordinance addressing emissions from agricultural activities; and
- Create a CSA or other similar mechanism to fund implementation of the SIP.

SCAQMD Rules and Regulations

The SCAQMD is responsible for controlling stationary air pollution sources. Therefore, its *Rules and Regulations* address a wide variety of industrial and commercial operations and require operational controls on many processes. In 1992, Rule 403 was amended to tighten controls on blowing dust from construction sites, landfills, open pit mines and other operations. This Rule 403 amendment was projected to reduce PM₁₀ emissions in the Coachella Valley by 22 tons per day.

The SCAQMD has adopted Rule 1403 which outlines the work practice requirements for demolition and renovation activities involving asbestos containing materials. Any person(s) undertaking a renovation involving 100 square feet or more of asbestos containing material or any kind of demolition must provide written notification to the SCAQMD ten days prior to the start of such activity. Completion of the District's notification form with details regarding the removal, handling, labeling, storing, and disposal of asbestos containing materials by the applicant is required.

Regulation XV (Rule 1501) required employers of 100 or more at a single worksite to develop innovative ways to reduce employee trips, both through transportation alternatives (like carpools, vanpools and bicycle facilities) and other techniques (such as 4-day work weeks, telecommuting and subsidizing public transit options) and submit Trip Reduction Plans to the SCAQMD. Rule 1502 defined the term "worksite" as "... a building, or grouping of buildings...which are in actual physical contact or separated solely by a private or public roadway or other private or public right-of-way, and which are owned and operated by the same employer (or by employers under common control)."

As a result of recent legislation (SB 772, chaptered in 1995), the SCAQMD is now prohibited from enforcing rules requiring employee trip reduction plans. A Regulation XV task force was formed to consider modifications to Regulation XV by exploring alternate and more cost-effective vehicle pollution strategies that are consistent with state and federal mandates. As a result, the Regulation XV rideshare program was replaced with an equivalent emission reduction program under Rule 2202, which was adopted in 1995.

Thresholds of Significance

With respect to Air Quality issues, impacts are considered significant when the project could cause an exceedance of any state or federal ambient air quality standard or make an existing exceedance of an ambient air quality standard measurably worse. Although the General Plan is only a policy document and would not directly cause air quality impacts, it is evaluated for air quality impacts under the thresholds stated above because it lays the groundwork for future project approvals.

Project Impacts and Mitigation Provided by General Plan Policy

Two types of air pollutant sources must be considered with respect to the proposed General Plan Update: stationary sources and mobile sources. Stationary source considerations include emissions from construction activities and natural gas combustion, as well as emissions at the power plant associated with the electrical requirements of development. Mobile source considerations include exhaust emissions resulting from short-term construction activities and long-term vehicular travel associated with the proposed General Plan Update.

Short-Term Construction-Related Impacts

Short-term impacts on air quality will occur during the construction activities required to implement the land uses in the proposed General Plan.

At the General Plan level of analysis, precise quantification of construction level emissions is not possible, since the City of Coachella has no direct control over the housing market, local financing or developer schedules. However, air quality impacts resulting from construction activities could be significant, as shown below. Consequently, the General Plan includes policies designed to reduce these impacts.

Field Office Stationary Source Emissions

Typically a field office is located at a construction site. Operation of a field office during construction activities would result in air pollutant emissions at the power plant supplying its electricity or from the use of gasoline-powered portable generators at the construction site. In general, a 1,000 square foot field office would generate negligible amounts of air pollution (.0104 pounds of CO, .0005 pounds of VOC, .0596 pounds of NOx, .0062 pounds of SOx, and .0021 pounds of PM10 per day).

Construction Period Exhaust Emissions

Localized exhaust emissions will result from the use of construction equipment as the proposed General Plan is implemented. Exhaust emissions over a broader area will result from the transport of off-highway equipment and the construction crews to and from various construction sites within the Coachella planning area.

Diesel construction equipment constitutes approximately 90 percent of the heavy construction machinery in use today. It emits, on the average, almost two pounds of NOx (and smaller amounts of CO and VOC) for each hour of usage (EPA, AP-42). Construction equipment emission rates on very active days may total several hundred pounds of contaminants per hour.

The SCAQMD has derived a generalized factor (250,000 brake horsepower hours of energy to develop one acre of vacant land) for use in estimating construction equipment emissions for General Plan analyses. Although the total emissions from construction equipment that would result from developing all of the vacant acres involved in the proposed General Plan Update are finite, the daily emission rate would vary with the time interval over which the construction activities occurred and the level of construction activity at any given time.

The construction period emissions that would be generated to develop: one vacant acre, the 6,900± vacant acres within the incorporated limits of the City of Coachella, and the 18,100± vacant acres within the planning area are shown in Table 3.6-4 in terms of pounds or tons emitted over the entire construction period. To compare them to the SCAQMD significance thresholds (given as emissions per day or per quarter in Table 3.6-5) and identify the potential significance of the short-term impacts, assumptions must be made regarding the construction interval required to implement the proposed General Plan.

For a "worst case" short-term impact assessment, it was assumed that 18,100 acres of vacant land could be developed within 35 years. Given that 260 working days per year are typically available to construction crews, 2 acres would need to be developed per day to complete 18,100 acres of development in 35 years. Table 3.6-4 provides the construction equipment emissions by pollutant, assuming 2 acres were developed per day within the planning area. It also shows the daily emissions if only one acre were developed per day in the planning area and General Plan buildout within the incorporated City limits were to require 26.5 years to complete.

Table 3.6-4
Construction Period Equipment Exhaust Emissions^a

Scenario/Pollutant	Construction Equipment Exhaust Emissions	
	(Pounds)	(Tons)
Daily Emissions Generated To Develop One or Two Acres Per Day^b		
CO	2,533	1.27
VOC	556	0.28
NOx	6,063	3.03
SOx	513	0.26
PM10	497	0.25
Daily Emissions Generated To Develop 2.0 Acres Per Day^b		
CO	5,066	2.53
VOC	1,112	0.56
NOx	12,126	6.06
SOx	1,026	0.51
PM10	993	0.50
Emissions Generated To Develop 6,900 Vacant Incorporated Acres		
CO	17,477,974	8,739
VOC	3,837,555	1,919
NOx	41,833,150	20,917
SOx	3,541,189	1,771
PM10	3,427,203	1,714
Emissions Generated To Develop 18,100 Vacant Planning Area Acres^b		
CO	45,848,018	22,924
VOC	10,066,630	5,033
NOx	9,289,207	54,868
SOx	9,289,207	4645
PM10	8,990,198	4495

a. See the construction period equipment emissions worksheet in Appendix F for emission factors, assumptions and calculations.

b. The rate of development is a variable that is controlled by the economic climate and cannot be estimated with any degree of accuracy at the General Plan level of analysis. A development rate of one acre per day, for example, implies that a 1,000-acre site could be fully developed within 1,000 days and the General Plan planning area could be built out over the next 50 years (if construction activities were to occur on 365 days/year).

It can be seen from Table 3.6-4 and Table 3.6-5 that development at a rate of one acre per day within the planning area would result in exceedances of the SCAQMD threshold criteria for all pollutants. In fact, if the City of Coachella were to opt solely to reduce the rate of development in an attempt to avoid exceedances of the SCAQMD thresholds, it would have to restrict the rate of development within the study area to a maximum of 0.016 acre per day. At that development rate, the General Plan would not be implemented until more than 4,220 years had elapsed. Clearly, other measures are required to minimize short-term emissions, since essentially any development would generate a significant short-term impact and it is virtually impossible to mitigate short-term construction impacts to a level of insignificance.

Table 3.6-5
SCAQMD Significance Threshold Criteria^a
(Pounds/Day)

Pollutant	CO	VOC	NOx	SOx	PM ₁₀
Daily Operations Emissions Thresholds					
- Pounds/Day	550	75	100	150	150
Quarterly Construction Emissions Thresholds					
- Pounds/Day	550	75	100	150	150
- Tons/Quarter	24.75	2.5	2.5	6.75	6.75

a. SCAQMD, *CEQA Air Quality Handbook*; November, 1993.

General Plan policies incorporate SCAQMD recommendations to assist in reducing construction emissions including requiring adequate watering of construction sites, requiring paving of access roads, and requiring that trucks hauling loose dirt material be covered.

Graded Surface PM₁₀ Emissions

Sources of construction activity PM₁₀ typically include: grading, demolition (when applicable), heavy-duty equipment on paved and unpaved roads and the loading and unloading of trucks when cut and fill quantities are not balanced on a particular site. An average PM₁₀ emission factor for construction activities is 26.4 pounds of PM₁₀ per day per acre disturbed.¹⁷ This factor can be reduced by half through regular watering.

Since the number of disturbed acres can not be accurately estimated at the General Plan level of analysis, an effort has been made to determine the number of acres that can be graded or disturbed without exceeding the SCAQMD significance threshold of 150 pounds of PM₁₀ per day. It was determined that with adequate water control, 11 acres could be disturbed daily without exceeding the threshold. Water control is a standard requirement of the City of Coachella.

¹⁷ SCAQMD, *CEQA Air Quality Handbook*; 11/93; Table A9-9; pg A9-93.

Based on the SCAQMD graded surface factor of 26.4 pounds of PM10 per day per acre, with 1 to 2 acres of the planning area in a disturbed state on 65 working days per quarter) construction, of a future project would generate 26.4 to 52.8 pounds of PM10 per day or 0.9 to 1.7 tons of PM10 per quarter.¹⁸ Therefore, surface grading PM10 emissions will not exceed the SCAQMD significance threshold of 6.75 tons per quarter.

Future project proponents will comply with SCAQMD Rule 403 which prohibits the release of fugitive dust emissions from any active operation, open storage pile, or disturbed surface area beyond the property line of the emission source. Particulate matter deposits on public roadways are also prohibited. General Plan policies requires future project proponents to comply with all reasonably available control measures, as part of the development review process to mitigate air quality impacts.

Paving Material and Architectural Coating Emissions

Volatile organic compound (VOC) emissions will occur as a result of surface coating and paving materials used during future construction processes. SCAQMD Rule 1108¹⁹ prohibits the use of rapid and medium cure cutback asphalts in the South Coast Air Basin (asphalt can contain no more than 0.5% by volume organic compounds). Further, Rule 1108.1 prohibits any organic compounds in emulsified asphalts. Therefore, it is expected that VOC emissions, as a result of paving activities, will be minor.

The volatile organic compound content of architectural coating materials (paint, varnish, lacquer, primer, etc.) will not be permitted to exceed the SCAQMD's Rule 1113 architectural coating threshold of 2.08 pounds of VOC per gallon. Most, if not all, of the VOCs will evaporate during the surface coating application and drying process.

Long-Term Operational Impacts

Air Pollutant Emission Projections

Emission projections can be made for the proposed General Plan buildout year by multiplying anticipated motor vehicle, natural gas, and electrical usage rates by the appropriate emission factors (EMFAC7EP). The results obtained in this manner are detailed in Appendix E and summarized in Table 3.6-6, which provides the future daily buildout air pollutant emissions associated with the proposed General Plan.

**Table 3.6-6
Proposed General Plan Buildout Air Pollutant Emissions^a**

Primary Pollutant	Natural Gas (Lbs./Day)	Electricity (Lbs./Day)	Vehicular (Lbs./Day)	Total (Lbs./Day)
CO	136.98	537.25	174,623.12	175,297
VOC	36.30	26.86	18,776.85	18,840
NOx	1,635.21	3,089.21	32,762.33	37,487
SOx	Negl.	322.35	3,102.26	3,425
PM10	1.37	107.45	6,287.37	6,396

a. See Appendix G for assumptions and calculations. Year 2009 EMFAC7EP emission factors were assumed.

¹⁸ SCAQMD, *CEQA Air Quality Handbook*, April 1993, Table 9-9.

¹⁹ Telephone communication with Ms. Linda Basilio, SCAQMD, on 4/30/93.

The proposed General Plan would generate: 175,297 pounds of carbon monoxide; 18,840 pounds of volatile organic gases; 37,487 pounds of NO_x; 3,425 pounds of SO_x; and 6,396 pounds of particulates daily, once completed. These emissions projections include hot start, cold start, hot soak, and diurnal emissions. Of the total project-related emissions, approximately 2.4% would be emitted by stationary sources and 97.6% would be emitted over a broad area by motor vehicles.

Significance of Long-Term Emissions

As shown in Table 3.6-7, buildout of the proposed General Plan would exceed the SCAQMD threshold criteria for all pollutants on a long-term basis. Since long-term project-related emissions would be considered a significant adverse impact by the SCAQMD, General Plan policy encourages the City to improve the area jobs/housing balance and reduce VMT to the maximum extent feasible to reduce adverse long-term effects on air quality.

**Table 3.6-7
Significance Of Long-Term Impacts**

Primary Pollutant	Proposed General Plan Buildout Emissions (Lbs./Day)	SCAQMD Threshold ^a (Lbs./Day)
CO	97,011	550
VOC	18,897	75
NO _x	15,783	100
SO _x	1,238	150
PM10	2,550	150

a. SCAQMD, *CEQA Air Quality Handbook*; November, 1993.

Toxic and Hazardous Emissions

Although the number and nature of future additional air pollutant point sources is presently unknown, each individual source will be required to comply with South Coast Air Quality Management District Rules and Regulations. Air pollution regulations at the state and federal level have historically focused on the criteria pollutants (NO_x, SO_x, CO, lead, particulates, and ozone). However, in the past decade, there has been growing concern regarding the potential impacts of other harmful pollutants emitted to the air. These are generally referred to as toxic air contaminants or Hazardous Air Pollutants (HAPs).

Title III of the federal Clean Air Act provides a program for the control of 189 HAPs. The SCAQMD has developed a number of rules and regulations directed at HAPs to meet state and federal requirements. Through its Title V permitting program, the SCAQMD will implement the national emission standards for HAPs when they are promulgated by insuring that maximum available control technology is implemented by major sources to reduce HAP emissions by new and existing sources. These regulations require that sources of hazardous materials or criteria pollutants above threshold levels obtain permits prior to operation of the facility.

The Tanner Toxics Act (AB 1807), the Air Toxics Hot Spots Assessment Program (AB 2588), the Toxic Emissions Near Schools Program (AB 3205), and the Disposal Site Air Monitoring Program (AB 3374) have been enacted by the State Legislature to deal with toxic air contaminants. These programs are all being implemented by the SCAQMD.

Air Quality Projections

An assessment of the project-related impact on localized ambient air quality requires that future ambient air quality levels be projected. Carbon monoxide concentrations were estimated adjacent to three intersections carrying appreciable volumes of project-related traffic using the CALINE 4 Dispersion Model.

Carbon monoxide levels in the project vicinity during peak hour traffic were assessed with the CALINE 4 computer model at the intersections most affected by project-related traffic. To simulate "worst case" meteorological conditions, a wind speed of 0.5 meter per second (1 mph) and Stability Class G were assumed for 1-hour averaging periods. A "worst case" wind direction of ten degrees from parallel on the highest volume roadway link was assumed since near parallel winds result in the highest carbon monoxide concentrations at receptors adjacent to the roadway. A comparison of the projected carbon monoxide levels to state and federal standards indicates the significance of the projected concentrations.

Since eight-hour traffic projections were unavailable, eight-hour carbon monoxide levels could not be projected directly with the CALINE 4 model. Caltrans has developed a recommended methodology for projecting 8-hour concentrations from the 1-hour CALINE 4 forecasts. The methodology multiplies the concentrations generated by local roadways (total concentrations less background) by a persistence factor. This quantity is then added to a suitable 8-hour background concentration. It has been determined that the appropriate persistence factor is 0.50 for the Coachella planning area.

The scenario analyzed reflects buildout traffic volumes for the proposed General Plan in the City of Coachella. As shown in Table 3.6-8, carbon monoxide concentrations adjacent to the three intersections analyzed will be below the 20 ppm state standard and 35 ppm federal standard (1-hour average) with buildout of the proposed General Plan. Similarly, the state and federal 8-hour carbon monoxide standards will not be exceeded in the Coachella planning area if the future background CO concentrations remain at the levels projected in the SCAQMD *CEQA Air Quality Handbook*.

Table 3.6-8
Proposed General Plan
Buildout Carbon Monoxide Concentrations^a

Receptor Distances ^b (Feet)	1-Hour Average (ppm)			8-Hour Average (ppm)		
	50	100	200	50	100	200
Harrison Street @						
- Avenue 52	1.6	0.8	0.5	0.8	0.4	0.3
- Avenue 54	1.5	0.7	0.4	0.8	0.4	0.2
SR 86 Freeway @						
- Avenue 52	2.7	1.4	0.8	1.4	0.7	0.4
Background CO Concentration^c	5.5	5.5	5.5	2.7	2.7	2.7
State Standard	20.0	20.0	20.0	≥9.1	≥9.1	≥9.1
Federal Standard	35.0	35.0	35.0	≥9.5	≥9.5	≥9.5

a. Year 2009 emission factors were assumed, since none are currently available for the buildout year.

b. Receptor distances are measured from the roadway centerline.

c. Source: SCAQMD, *CEQA Air Quality Handbook*; 11/93; Tables 5-2 and 5-3, pg. 5-15 and 5-16.

Over a 1-hour averaging period, "worst-case" traffic associated with buildout of the proposed General Plan would contribute up to 2.7 ppm to the carbon monoxide concentration at 50 feet from the roadway centerlines. The highest carbon monoxide level expected will occur at 50 feet from Avenue 52, where it meets the SR 86 Freeway. It will reach 8.2 ppm over a 1-hour averaging period and 4.1 ppm over an 8-hour averaging period.

A project has a significant impact if it interferes with the attainment of the state 1-hour or 8-hour carbon monoxide standards by either exceeding them or contributing to an existing or projected violation. The proposed project will not cause state CO standard exceedances in the vicinity or contribute to an existing or projected violation.

Relevant Planning Programs

Air Quality Management Plan

Many of the land use, growth management and transportation policies specified as control measures in the AQMP can only be implemented through inclusion in local General Plans. Unless a local commitment is made to use existing resources more efficiently with emphasis on conservation tactics and the substitution of renewable resources for non-renewable ones, the air quality benefits from the control measures outlined in the AQMP will not be realized.

Providing a balance between employment opportunities and the local housing supply lowers emissions by producing shorter commutes, more efficient travel patterns and reduced congestion. Local land use plans provide the most efficient mechanism for anticipating, controlling and limiting changes to the mix, location and density of land use to balance jobs and housing. The AQMP suggests that local jurisdictions counteract the incentive to develop open spaces and agricultural land by preserving these uses and using developed land more efficiently by in-filling, redeveloping, and land use intensification. General Plan policy encourages a balance between housing and employment and the orderly growth of the City. The General Plan preserves large areas of existing agricultural land.

City of Coachella General Plan

The City of Coachella is currently in the process of addressing potential air quality issues through the development and adoption of General Plan objectives, policies and implementation programs. The implementation programs as well as applicable SCAQMD Rules and Regulations, commit the City to mitigation that will reduce construction-related and operational air quality impacts. The proposed General Plan contains objectives and policies regarding improvements to circulation which will be carried out through the development review process. One primary objective of these programs is to reduce vehicle trips and vehicle miles traveled, thereby improving air quality.

The City's General Plan also contains an implementation program for the core of the AQMP control measures: (e.g. adoption of a Transportation Demand Management Ordinance, implementation of transit and rideshare (carpool, vanpool) programs and adoption of dust emissions controls). Once the proposed General Plan text is adopted, the City will develop these programs and future development projects within the City of Coachella will be required to implement them.

Additional Mitigation and Unmitigable Impacts

Although the General Plan seeks to implement measures to reduce short term and long term pollutant emissions, SCAQMD thresholds for all criteria pollutants would still be exceeded. This is considered a significant unmitigable adverse impact resulting from General Plan buildout.

3.7 Noise

The following text is based upon the *City of Coachella General Plan Update Noise Element Background Study* prepared by Endo Engineering specifically for this Environmental Impact Report (EIR) and is included as Appendix E in the Technical Appendices, bound separately.

Fundamentals of Noise

Noise levels are measured on a logarithmic scale in decibels which are then weighted and added over a 24-hour period to reflect not only the magnitude of the sound, but also its duration, frequency, and time of occurrence. In this manner, various acoustical scales and units of measurement have been developed such as: equivalent sound levels (Leq), day-night average sound levels (Ldn) and community noise equivalent levels (CNEL's).

A-weighted decibels (dBA) approximate the subjective response of the human ear to a broad frequency noise source by discriminating against the very low and high frequencies of the audible spectrum. They are adjusted to reflect only those frequencies which are audible to the human ear. The decibel scale has a value of 1.0 dBA at the threshold of hearing and 140 dBA at the threshold of pain. Each interval of 10 decibels indicates a sound energy ten times greater than before, which is perceived by the human ear as being roughly twice as loud. Therefore, a 1.0 decibel increase is just audible whereas a 10 decibel increase means the sound is perceived as being twice as loud as before.

Examples of the decibel level of various noise sources include the quiet rustle of leaves (10 dBA), a motion picture studio (20 dBA), a library (35 dBA), ambient noise outdoors (50 dBA), normal conversation at 5 feet (55 dBA), or a busy street at 50 feet (75 DBA).

Noise Rating Schemes

Equivalent sound levels are not measured directly but rather calculated from sound pressure levels typically measured in A-weighted decibels (dBA). The equivalent sound level (Leq) is the constant level that, over a given time period, transmits the same amount of acoustic energy as the actual time-varying sound. Equivalent sound levels are the basis for both the Ldn and CNEL scales.

Day-night average sound levels are a measure of the cumulative noise exposure of the community. The Ldn value results from a summation of hourly Leq's over a 24-hour time period with an increased weighing factor applied to the nighttime period between 10:00 pm and 7:00 am. This noise rating scheme takes into account those subjectively more annoying noise events which occur during the normal sleeping hours.

Community noise equivalent levels (CNEL) also carry a weighting penalty for noises that occur during the nighttime hours. In addition, CNEL levels include a penalty for noise events that occur during the evening hours between 7:00 pm and 10:00 pm. Because of the weighting factors applied, CNEL values at a given location will always be larger than Ldn values, which in turn will exceed Leq values. However, CNEL values are typically within one decibel of the day-night average sound level.

Sound Propagation

For a "line source" of noise such as a heavily traveled roadway, the noise level drops off by a nominal value of 3.0 decibels for each doubling of distance between the noise source and noise receiver. Environmental factors such as the wind direction and speed, temperature gradients, the characteristics of the ground (hard or soft) and the air (relative humidity), the presence of grass, shrubbery, and trees, combine to increase the typical attenuation achieved outside laboratory conditions to 4.5 decibels per doubling of distance.

This is particularly true for freeways where an elevated profile, higher truck mix, or the presence of intervening buildings or topography often come into play; and where the view of a roadway is interrupted by isolated buildings, clumps of bushes, scattered trees, or the intervening ground is soft or covered with vegetation and the source or receiver is located more than three meters above the ground. It should be noted, however, that the nominal value of 3.0 dBA with doubling applies to sound propagation from a "line source" which is over the top of a barrier greater than 3 meters in height, or where there is a clear unobstructed view of the highway, the ground is hard, there are no intervening structures and the height of the line-of-sight between the noise source and the noise receiver averages more than 3 meters above the ground.

In an area which is relatively flat and free of barriers, the sound level resulting from a single "point source" of noise drops by 6 decibels for each doubling of distance or 20 decibels for each factor of ten in distance. This applies to fixed noise sources and mobile noise sources which are temporarily stationary such as an idling truck or other heavy duty equipment operating within a confined area (such as industrial processes). Sound propagation from a train resembles a "line source" near the railroad tracks and a point source at distances beyond three-tenths of the train length.

The noise levels adjacent to line sources such as roadways increase by 3.0 dBA with each doubling in the traffic volume (provided that the speed and truck mix do not change). From the mathematical expression relating increases in the number of noise sources (motor vehicles) to the increase in the adjacent noise level, it can be shown that a 26 percent increase in the traffic volume will cause a 1.0 dBA increase in adjacent noise levels. Doubling the number of vehicles on a given route increases the adjacent noise levels by 3.0 dBA, but changing the vehicle speed has an even more dramatic effect.

Increasing the vehicle speed from 35 to 45 mph raises the adjacent noise levels approximately 2.5 dBA. Reducing vehicle speeds from 35 to 30 mph decreases adjacent noise levels by 1.5 dBA on major roadways and 1.6 dBA on secondary and collector roadways. A speed decrease from 40 mph to 35 mph reduces adjacent noise levels by 1.3 dBA on majors and 1.4 dBA on secondaries and collectors. Consequently, lowering motor vehicle speeds can have a significant positive impact in terms of reducing adjacent noise levels.

The truck mix on a given roadway also has a significant effect on the adjacent noise levels. As the number of trucks increases and becomes a larger percentage of the total vehicle volume, the adjacent noise levels increase. This effect is more pronounced if the number of heavy duty (3+ axle) trucks is large when compared to the number of medium duty (2 axle) trucks.

Air temperature and humidity seldom have a significant effect on adjacent noise contours. Temperature gradients can bend or reflect noise back down to earth (usually at distances exceeding one-half mile). Wind speed and wind direction have an effect on the noise levels, but the effects are not consistent. Sound traveling with the wind is bent down to earth and sound traveling against the wind is bent upwards above the earth. Although irregular, turbulent or gusty winds cause fluctuations in sound transmissions, standard noise modeling practice does not account for any of these factors in steady state noise control.

Atmospheric effects seldom have any significant effect on noise levels at the relatively short distances from the highway to the adjacent residents. Although in some instances short duration intermittent or temporary atmospheric effects can be significant, these are not taken into account for steady-state noise control. Moreover, any small effect created by these factors would be masked by larger variations due to topography, ground absorption, vehicular speed, and roadway alignment. For example, variations in humidity can change the actual distance to a particular noise contour by as much as 6 feet, if it is located through computer modeling 800 feet from the roadway.

Human Reactions to Sound

Noise can cause temporary physical and psychological responses in humans. Temporary physical reactions to passing noises range from a startle reflex to constriction in peripheral blood vessels, the secretion of saliva and gastric juices, and changes in heart rate, breathing patterns, the chemical composition of the blood and urine, the dilation of the pupils of the eye, visual acuity and equilibrium. The chronic recurrence of these physical reactions has been shown to aggravate headaches, cause fatigue, digestive disorders, heart disease, circulatory and equilibrium disorders. Moreover, as a source of stress, noise is a causal factor in stress-related ailments such as ulcers, high blood pressure and anxiety.

Three harmful effects of noise which are commonly of concern include speech interference, the prevention or interruption of sleep, and hearing loss. Excessive background noises can reduce the amount and quality of verbal exchange and thereby impact education, family life-styles, occupational efficiency, and the quality of recreation and leisure time. Speech interference begins to occur at about 40 to 45 decibels and becomes severe at about 60 decibels. Background noise levels affect performance and learning processes through distraction, reduced accuracy, increased fatigue, annoyance and irritability, and the inability to concentrate (particularly when complex tasks are involved or in schools where younger children exhibit imprecise speech patterns and short concentration spans).

Several factors determine whether or not a particular noise event will interfere with or prevent sleep. These factors include the noise level and characteristics, the stage of sleep, the individual's age and motivation to waken. Ill or elderly people are particularly susceptible to noise-induced sleep interference, which can occur when intruding noise levels exceed the typical 35-45 decibel background noise level in bedrooms. Sleep prevention can occur when intruding noise levels exceed 50 dBA.

Hearing loss, which may begin to occur at 75 dBA, is one of the most harmful effects of noise on people. Approximately 20 million people in the United States currently have some degree of hearing loss. In many of these cases, exposures to very loud, impulsive, or sustained noises caused damage to the inner ear which was substantial even before a hearing loss was actually noticed. To prevent the spread of hearing loss, a desirable goal would be to minimize the number of noise sources which expose people to sound levels above 70 decibels.

Community Responses to Noise

Approximately 10 percent of the population has a very low tolerance for noise and will object to any noise not of their own making. Consequently, even in the quietest environment, some complaints will occur. Another 25 percent of the population will not complain even in very severe noise environments. Thus, a variety of reactions can be expected from people exposed to any given noise environment.

Despite this variability in behavior on an individual level, the population as a whole can be expected to exhibit the following responses to changes in noise levels: an increase or decrease of 1.0 dBA cannot be perceived except in carefully controlled laboratory experiments; a 3.0 dBA increase is considered just noticeable outside of the laboratory; an increase of 5.0 dBA is often necessary before any noticeable change in community response (i.e., complaints) would be expected.

Community responses to noise may range from registering a complaint by telephone or letter, to initiating court action, depending upon each individual's susceptibility to noise and personal attitudes about noise. Several factors are related to the level of community annoyance including: (1) fear associated with the noise producing activities; (2) socio-economic status and educational level of the residents; (3) resident conviction that they are being fairly treated; (4) attitudes regarding the usefulness of the noise producing activity; and (5) resident belief that the noise source can be controlled.

Recent studies have shown that changes in long-term noise levels measured in units of Ldn or CNEL, are noticeable and are responded to by people. About 10 percent of the people exposed to traffic noise of 60 Ldn will report being highly annoyed with the noise, and each increase of one Ldn is associated with approximately 2 percent more people being highly annoyed. When traffic noise exceeds 60 Ldn or aircraft noise exceeds 55 Ldn, people begin complaining. Group or legal actions to stop the noise should be expected to begin at traffic noise levels near 70 Ldn and aircraft noise levels near 65 Ldn.

Land Use Compatibility with Noise

As ambient noise levels affect the perceived amenity or livability of a development, so too can the mismanagement of noise impacts impair the economic health and growth potential of a community by reducing the area's desirability as a place to live, shop and work. For this reason, land use compatibility with the noise environment is an important consideration in the planning and design process.

Some land uses are more tolerant of noise than others. For example, schools, hospitals, churches and residences are more sensitive to noise intrusion than commercial or industrial activities. For this reason, land use compatibility with the noise environment is an important consideration in the planning and design of new developments. As ambient noise levels affect the perceived amenity or livability of a development, so too can the mismanagement of noise impacts impair the economic health and growth potential of a community by reducing the area's desirability as a place to live, shop and work.

Noise Policies and Standards

Various forms of legislation and governmental standards have been developed to address the effects of noise. These are summarized below and described in detail in Appendix F.

Federal Policies and Standards

The federal Quiet Communities Act of 1978 amended the Noise Control Act of 1972 to encourage noise control programs at the state and community level. As part of the implementing regulations, the Federal Highway Administration (FHWA) developed a set of maximum noise levels for use in determining when noise mitigation is necessary for highway improvements funded with FHWA moneys.

The United States Department of Housing and Urban Development (HUD) has adopted goals that exterior noise levels should not exceed an Ldn of 55 decibels and that interior noise levels should not exceed an Ldn of 45 decibels. However, HUD has developed criteria which allow sites with an Ldn of 65 to be eligible for HUD financial assistance.

The federal Environmental Protection Agency (EPA) has recommended 55 dB Ldn as a goal for exterior noise levels in residential areas.

State Policies and Standards

The Caltrans Aeronautics Program noise standards specify 65 dB CNEL as the standard which airports must meet to protect existing residential communities and schools from unacceptable exterior exposures to aircraft noise.

The Government Code (Section 65302(f)) specifies that general plans shall analyze and quantify current and projected noise levels within the community; establish land use patterns that minimize exposure to excessive noise; and include implementation measures to address noise problems.

The Department of Health Services has developed criteria and guidelines for local agencies to use in setting standards for human exposure to noise and establishing compatible land uses. These guidelines are provided in Figure 3.7-1, Land Use Compatibility for Community Noise Environments. Each locality, in developing a noise element, must make a determination regarding how much noise is too much. The adjustment factors given in Table 3.7-1, Corrections to be Added to the Measured CNEL to Obtain Normalized CNEL, may be used to arrive at noise acceptability standards which more accurately reflect the noise control goals of the community.

Where a land use is denoted as "Normally Acceptable" in Figure 3.7-1, the highest noise level in that range should be considered the maximum desirable for existing or conventional building construction which does not incorporate any special acoustic treatment. The acceptability of noise environments classified as "Conditionally Acceptable" or "Normally Unacceptable" should include consideration of the type of noise source, the sensitivity of the noise receptor, the noise reduction likely to be provided by structures, and the degree to which the noise source may interfere with speech, sleep or other activities that are characteristic of the land use.

As shown in Figure 3.7-1, the highest recommended exterior noise level for commercial uses is 70 dBA Ldn. With regard to residential uses, the recommended outdoor noise limits of 60 dBA Ldn and 65 dBA Ldn (for single family and multi-family residences, respectively) would permit achievement of the 45 dB interior noise level recommended by federal and state standards. This level would result from the noise reduction associated with typical residential construction, which ranges from 12 to 18 dB (with windows partially open).

The California Administrative Code includes noise insulation standards which detail specific requirements for new multi-family structures located within the 60 CNEL contour adjacent to roads, railroads, rapid transit lines, airports or industrial areas.¹ An acoustic analysis is required showing that these multi-family units have been designed to limit interior noise levels with doors and windows closed to 45 CNEL in any habitable room.

Local Policies and Standards

The City of Coachella has adopted specific interior and exterior noise standards that were included in the 1987 City of Coachella General Plan Noise Element. These standards are reproduced in Figure 3.7-2, Interior and Exterior Noise Standards.

Existing Noise Environment

As a prerequisite to an effective noise control program, a community must be cognizant of the location and extent of local noise problems; namely major noise source locations, the type of sensitive receptors exposed, and what levels of exposure exist. This data can be utilized to focus noise control and abatement efforts. In some cases, the control of offending noise sources will be beyond the City's jurisdiction; however, by recognizing these limitations more effective land use strategies can be developed.

¹ An exception is made for railroads where there are no nighttime (10pm to 7am) operations and where daytime (7am to 10 pm) operations do not exceed four per day.

Interpretation

Normally Acceptable

Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements

Conditionally Acceptable

New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Normally Unacceptable

New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made with needed noise insulation features included in the design.

Clearly Unacceptable

New construction or development should generally not be undertaken.

Land Use Category	Community Noise Exposure Ldn or CNEL, dB					
	55	60	65	70	75	80
Residential - Low density Single Family, Duplex, Mobile Homes						
Residential - Multiple Family						
Transient Lodging - Motels, Hotels						
Schools, Libraries, Churches, Hospitals, Nursing Homes						
Auditoriums, Concert Halls, Amphitheaters						
Sports Arena, Outdoor Spectator Sports						
Playgrounds, Neighborhood Parks						
Golf Courses, Riding Stables, Water Recreation, Cemeteries						
Office Buildings, Business, Commercial and Professional						
Industrial, Manufacturing, Utilities, Agriculture						

Source: Endo Engineering

California Dept. of Health Services, "Guidelines for the Preparation and Content of the Noise Element of the G.P.", 1990

Land Use Compatibility for Community Noise Environments

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Figure No. 3.7-1



Table 3.7-1
Corrections to be Added to the Measured CNEL
to Obtain Normalized CNEL*

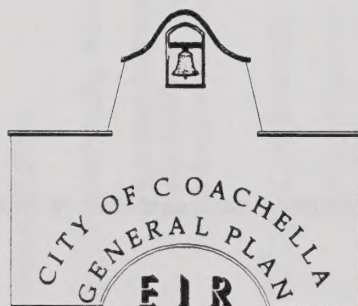
Type of Correction	Description	Amount of Correction to be Added to Measured CNEL in dB
Seasonal Correction	Summer (or year-round operation).	0
	Winter only (or windows always closed).	-5
Correction for Outdoor Residual Noise Level	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking).	+10
	Quiet suburban or rural community (not located near industrial activity).	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas).	0
	Noisy urban residential community (near relatively busy roads or industrial areas).	-5
	Very noisy urban residential community.	-10
Correction for Previous Exposure and Community Attitudes	No prior experience with the intruding noise.	+5
	Community has had some previous exposure to noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good.	-5
	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive in character.	0
	Pure tone or impulsive character present.	-5

* California Department of Health Services, "Guidelines for the Preparation and Content of Noise Elements of the General Plan", November 1990.

LAND USE CATEGORIES		ENERGY AVERAGE CNEL (dB)	
Category	Uses	Interior ¹	Exterior ²
Residential	Single Family Duplex, Multiple Family	45 ³	65
	Mobile Home	—	65 ⁴
Commercial Industrial Institutional	Hotel, Motel, Transient Lodging	45	65 ⁵
	Commercial Retail, Bank, Restaurant	55	—
	Office Building, Research and Development, Professional Offices, City Office Building	50	—
	Amphitheatre, Concert Hall, Auditorium, Meeting Hall	45	—
	Gymnasium (Multipurpose)	50	—
	Sports Club	55	—
	Manufacturing, Warehousing, Wholesale, Utilities	65	—
	Movie Theatres	45	—
Institutional	Hospital, School Classroom	45	65
	Church, Library	45	—
Open Space	Parks	—	65

Interpretation

- Indoor environment excluding: bathrooms, toilets, closets, corridors.
- Outdoor environment limited to: Private yard of single family
Multi-family private patio or balcony served by a means of exit from inside
Mobile home park
Hospital patio
Park's picnic area
School playground
Hotel and motel recreation area.
- Noise level requirement with closed windows. Mechanical ventilating system or other means of natural ventilation shall be provided per Chapter 12, Section 1205 of Uniform Building Code.
- Exterior noise level should be such that interior noise level will not exceed 45 CNEL.
- Except those areas affected by aircraft noise.



Source:
Endo Engineering

Interior and Exterior Noise Standards

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Figure 3.7-2

Noise Sensitive Receptors

Land uses deemed noise sensitive by the State of California include: schools, hospitals, rest homes, long-term care and mental care facilities. Some jurisdictions elect to also consider day care centers, single family dwellings, mobile home parks, churches, libraries, and recreation areas sensitive to noise. Moderately sensitive land uses typically include: multi-family dwellings, hotels, motels, dormitories, out-patient clinics, cemeteries, golf courses, country clubs, athletic/tennis clubs and equestrian clubs.

Relatively insensitive uses are business, commercial, and professional developments. Insensitive noise receptors include industrial, manufacturing, utilities, agriculture, natural open space, undeveloped land, parking lots, motorcycle parks, rifle ranges, warehousing, liquid and solid waste facilities, salvage yards, and transit terminals.

Current land uses located within the City of Coachella General Plan Update planning area that are sensitive to intrusive noise include: a library, two health care facilities, a dozen schools, and residential areas. Figure 3.7-3, Existing Noise Sensitive Receptors, details the location of noise sensitive receptors.

Significant Noise Sources

There are stationary and mobile noise sources in the planning area. Fixed sources of noise include: agricultural activities, industrial operations and construction activities, air conditioning/refrigeration units, whistles or bells (signaling school breaks or shift changes), high level radio, stereo or television usage, power tools, lawnmowers, appliances used in the home, and barking dogs. Mobile noise sources are typically transportation-related and include: aircraft overflights associated with Thermal Airport, train operations on the Southern Pacific Railroad tracks parallel to Grapefruit Boulevard, automobiles, trucks, buses, motorcycles and off-road vehicles on Interstate 10, the SR 86 Expressway and the surface streets throughout the planning area.

Current Noise Levels

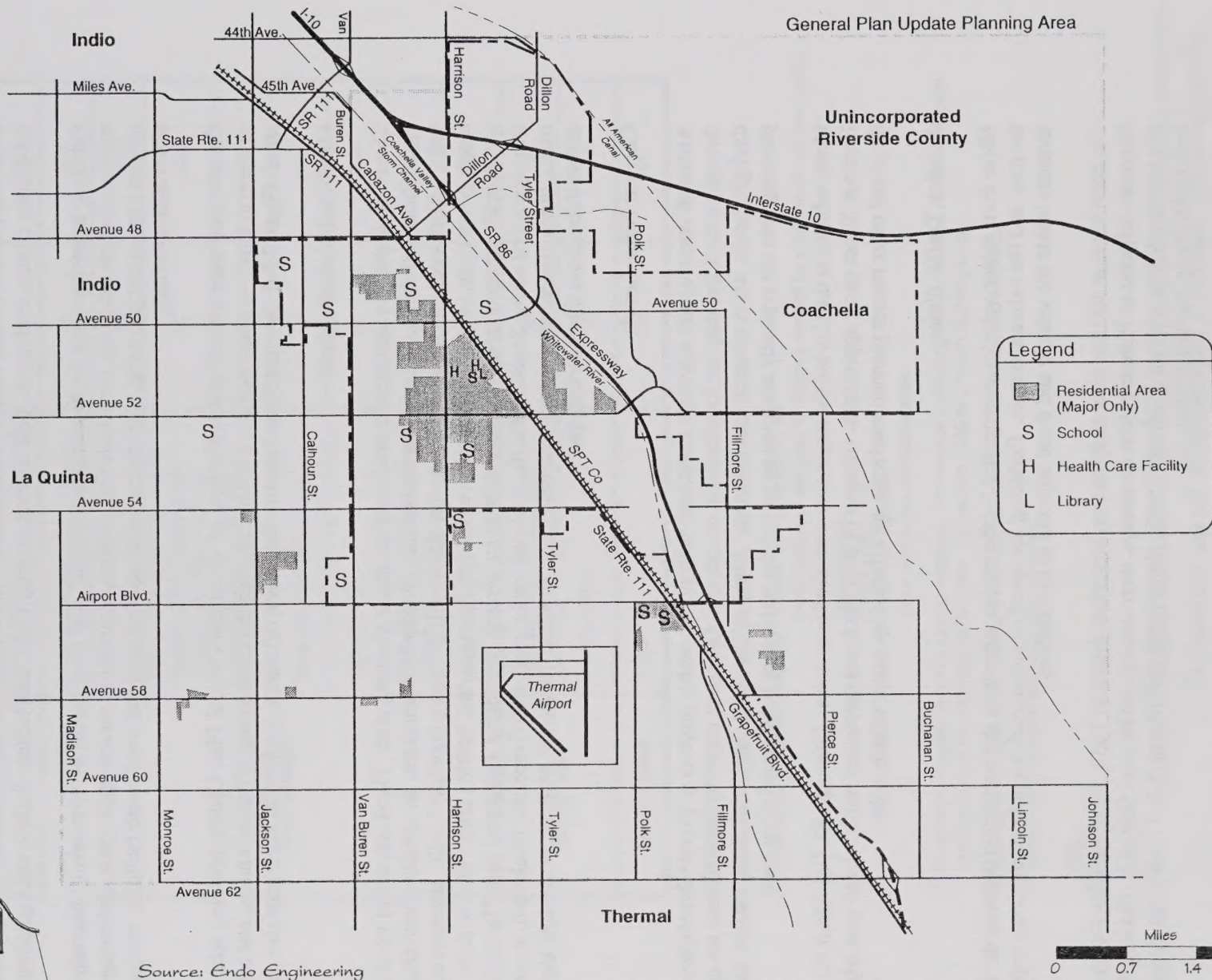
Although construction activities associated with public works projects or private development occur throughout the City, they are localized and temporary. Operating times for these sources are generally daylight hours when noise is less intrusive. Many of the fixed sources of noise located within the planning area are typically accepted as part of the ambient or background noise level.

Motor vehicles in the City are the major source of continuous noise. Interstate 10, Grapefruit Boulevard, Harrison Street carry appreciable volumes of both truck and commuter traffic. Land uses adjacent to these and other master planned roadways are affected by motor vehicle noise.

Existing Traffic Noise

Noise from motor vehicles is generated by the engine vibrations, the interaction between the tires and the road, and the exhaust system. Reducing the speed of motor vehicles reduces the noise exposure of listeners inside the vehicle and those adjacent to the roadway.

The noise levels at 100 feet from each roadway centerline shown in Table 3.7-2, Existing Exterior Noise Exposure Adjacent to Planning Area Roadways, were determined by modeling each roadway, freeway, or expressway link with the Highway Traffic Noise Prediction Model (RD-77-108), developed by the Federal Highway Administration.



Existing Noise Sensitive Receptors

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Figure No. 3.7-3

Table 3.7-2
Existing Exterior Noise Exposure Adjacent to Planning Area Roadways

Roadway	A.D.T.* (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Interstate 10					
-W/O Auto Center Dr.	24,000	76.0	229	485	1042
-E/O Auto Center Dr.	21,000	75.7	205	428	917
-W/O Dillon Road	15,000	73.6	167	355	762
-E/O Dillon Road	14,300	73.7	170	360	774
State Route 111					
-W/O Madison St.	22,000	66.9	66	131	278
-W/O Monroe St.	25,500	67.6	72	146	309
-W/O Jackson St.	25,000	67.5	71	143	304
-E/O Jackson St.	15,200	65.2	52	103	217
Auto Center Dr./SR 111					
-W/O Avenue 45	6,400	61.3	R/W	57	122
-E/O Avenue 45	6,300	61.6	R/W	65	125
Grapefruit Blvd./SR 111					
-N/O Van Buren St.	21,600	71.2	119	251	538
-S/O Van Buren St.	22,000	71.3	121	255	546
-S/O Dillon Road	28,500	72.5	143	304	653
-S/O Harrison St.	9,600	64.4	R/W	91	195
-S/O Avenue 50	11,900	64.5	R/W	93	198
-S/O Avenue 54	9,000	65.8	R/W	113	243
-S/O Airport Blvd.	8,500	64.0	R/W	86	185
-N/O Avenue 58	6,200	65.5	R/W	108	232
-S/O Avenue 62	5,800	65.2	R/W	103	222
State Route 86 Expressway					
-S/O Interstate 10	4,900	67.5	R/W	143	304
-N/O Avenue 58	3,400	65.9	R/W	114	239
Harrison Street					
-N/O Avenue 50	21,300	70.5	107	225	481
-S/O Avenue 50	21,200	70.5	107	225	481
-S/O Avenue 52	15,000	69.7	96	199	425
-S/O Avenue 54	11,900	69.7	96	205	443
-S/O Avenue 58	9,000	69.3	90	193	416
-S/O Avenue 60	11,400	70.3	105	225	485
Avenue 48/Dillon Road					
- W/O Madison St.	5,000	61.2	R/W	56	120
- W/O Jackson St.	8,300	63.7	R/W	84	171
- E/O Jackson St.	5,900	61.9	R/W	62	134
- E/O Van Buren St.	6,400	62.3	R/W	66	142
- W/O SR 86 Expressway	10,500	64.4	R/W	91	196
- W/O Interstate 10	7,100	63.0	R/W	76	154
- E/O Interstate 10	2,900	60.8	R/W	58	112
- N/O 44th Avenue	2,700	60.2	R/W	R/W	103

Table 3.7-2
Existing Exterior Noise Exposure Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Avenue 50					
- W/O Monroe St.	4,800	62.7	R/W	70	151
- W/O Jackson St.	5,200	63.1	R/W	75	161
- W/O Van Buren St.	5,400	63.3	R/W	77	166
- E/O Van Buren St.	9,500	64.0	R/W	86	185
- W/O Grapefruit Blvd.	3,800	60.0	R/W	R/W	100
- E/O Grapefruit Blvd.	3,900	60.1	R/W	R/W	102
Avenue 52					
- W/O Monroe St.	5,300	63.2	R/W	76	163
- W/O Jackson St.	4,000	62.0	R/W	63	136
- E/O Jackson St.	4,400	62.4	R/W	67	144
- W/O Harrison St.	5,600	63.4	R/W	78	168
- E/O Harrison St.	8,800	61.7	R/W	60	130
- E/O Grapefruit Blvd.	7,300	61.2	R/W	61	119
Avenue 54					
- W/O Harrison St.	1,000	55.9	R/W	R/W	R/W
- E/O Harrison St.	1,300	57.1	R/W	R/W	64
- W/O Grapefruit Blvd.	800	55.0	R/W	R/W	R/W
- E/O Grapefruit Blvd.	1,100	56.6	R/W	R/W	64
Airport Blvd.					
- W/O Monroe St.	600	52.9	R/W	R/W	R/W
- W/O Jackson St.	1,800	57.7	R/W	R/W	70
- E/O Jackson St.	1,400	57.4	R/W	R/W	67
- W/O Harrison St.	2,900	60.6	R/W	R/W	110
- E/O Harrison St.	3,000	60.7	R/W	R/W	111
- W/O Polk St.	3,700	61.6	R/W	60	128
- W/O Grapefruit Blvd.	3,000	57.1	R/W	R/W	64
- E/O Grapefruit Blvd.	3,600	57.8	R/W	R/W	71
Avenue 60					
- E/O Pierce St.	1,500	57.7	R/W	R/W	70
Avenue 62					
- E/O Harrison St.	1,300	57.1	R/W	R/W	64
- W/O Pierce St.	1,100	56.3	R/W	R/W	57
- E/O Grapefruit Blvd.	1,300	57.1	R/W	R/W	64
- W/O Lincoln St.	1,700	58.2	R/W	R/W	76
Madison Street					
- N/O SR 111	6,700	62.5	R/W	68	147
- N/O Avenue 48	5,600	61.7	R/W	60	130
- N/O Avenue 52	600	53.7	R/W	R/W	R/W
- N/O Airport Blvd.	2,000	59.1	R/W	R/W	88
- N/O Avenue 58	1,900	58.7	R/W	R/W	82
- N/O Avenue 60	200	48.9	R/W	R/W	R/W
Monroe Street					
- N/O Avenue 54	3,200	61.0	R/W	R/W	117
- N/O Avenue 58	2,000	58.9	R/W	R/W	85

Table 3.7-2
Existing Exterior Noise Exposure Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Jackson Street					
- N/O Avenue 52	4,600	62.6	R/W	69	149
- N/O Airport Blvd.	2,500	59.9	R/W	R/W	98
- N/O Avenue 60	1,500	57.7	R/W	R/W	70
- N/O Avenue 62	1,400	57.4	R/W	R/W	67
Calhoun Street					
- N/O Avenue 54	900	55.5	R/W	R/W	50
Van Buren Street					
- N/O Avenue 48	1,600	56.3	R/W	R/W	57
- N/O Avenue 50	1,600	56.3	R/W	R/W	57
- N/O Avenue 52	2,000	57.2	R/W	R/W	65
- N/O Avenue 54	2,200	57.6	R/W	R/W	69
- N/O Airport Blvd.	2,000	57.2	R/W	R/W	65
Polk Street					
- N/O Avenue 60	1,700	58.2	R/W	R/W	76
Pierce Street					
- N/O Avenue 62	800	55.0	R/W	R/W	47
a. A.D.T. means current average daily two-way traffic volume. b. CNEL values are given at 100 feet from all roadway centerlines (see Appendix C for assumptions). c. All distances are measured from the centerline. R/W means the contour falls within the right-of-way.					

As shown in Table 3.7-2, only 2 percent of the links modeled (Interstate 10 on both sides of Auto Center Drive) currently generate noise levels at a distance of 100 feet that exceed 75 CNEL. Some commercial, industrial and institutional land uses would be normally compatible with noise exposures above 75 CNEL.

Approximately 10 percent of the links evaluated (eight links) currently generate noise levels at 100 feet that are between 70 CNEL and 75 CNEL. These links include: Interstate 10 within the City Limits, three links along Grapefruit Boulevard (north of Harrison Street), and three links along Harrison Street (from Grapefruit Boulevard to Avenue 52 and south of Avenue 60). In addition to some commercial, industrial and institutional land uses, open space uses (other than parks) are normally compatible with noise exposures between 70 and 75 CNEL.

Of the eighty-four links modeled in the planning area, all but seventeen were found to generate a 70 CNEL contour that falls within the right-of-way. Twelve links (or 14 percent) of the links modeled were found to generate noise levels at 100 feet that were between 65 CNEL and 70 CNEL. These links include portions of Harrison Street, the SR 86 Expressway, Grapefruit Boulevard, and SR 111 (west of Auto Center Drive in Indio).

The roadways where current traffic volumes generate noise levels at 100 feet from the centerline that are above acceptable levels for noise sensitive receptors (65 CNEL) include the following:

- Interstate 10 (throughout the planning area);
- State Route 86 Expressway (throughout the planning area);
- Grapefruit Boulevard (six of the nine links modeled); and
- Harrison Street (between Avenue 48 and Avenue 62).

High noise levels are typically the result of: (1) large traffic volumes, (2) high vehicle speeds, and (3) high truck mixes. Grapefruit Boulevard and Harrison Street presently carry the largest traffic volumes of all surface streets within the City Limits. All of the roadway links generating sound levels in excess of 65.0 CNEL are designated as truck routes by the City.

Existing Railroad Noise

Freight railroad service is provided by the Southern Pacific Railroad in the City of Coachella. A Southern Pacific Railroad line passes diagonally through the planning area parallel and adjacent to the east side of Grapefruit Boulevard.

Data on railroad operations obtained from the Southern Pacific Transportation Company indicates that this line is used only for freight train operations and 40 trains per day typically pass through the planning area with an average of 80 cars per train (resulting in a train length of 5,200 feet). Approximately 5 of the trains pass through the planning area during the evening hours (between 7:00 PM and 10:00 PM) and another four trains pass through the area during the nighttime hours (between 10:00 PM and 7:00 AM). A typical train is pulled by 4 engines and typical train speeds are 50 miles per hour.

At 100 feet from the railway centerline, the noise level was determined to be 75.1 CNEL. The noise level at 200, 400, and 800 feet from the tracks is projected to be 71.1, 65.6, and 59.7 CNEL, respectively. The 65 CNEL contour is approximately 430 feet from the tracks, and the 60 CNEL contour is approximately 770 feet from the tracks. No measurements of railroad noise were made.

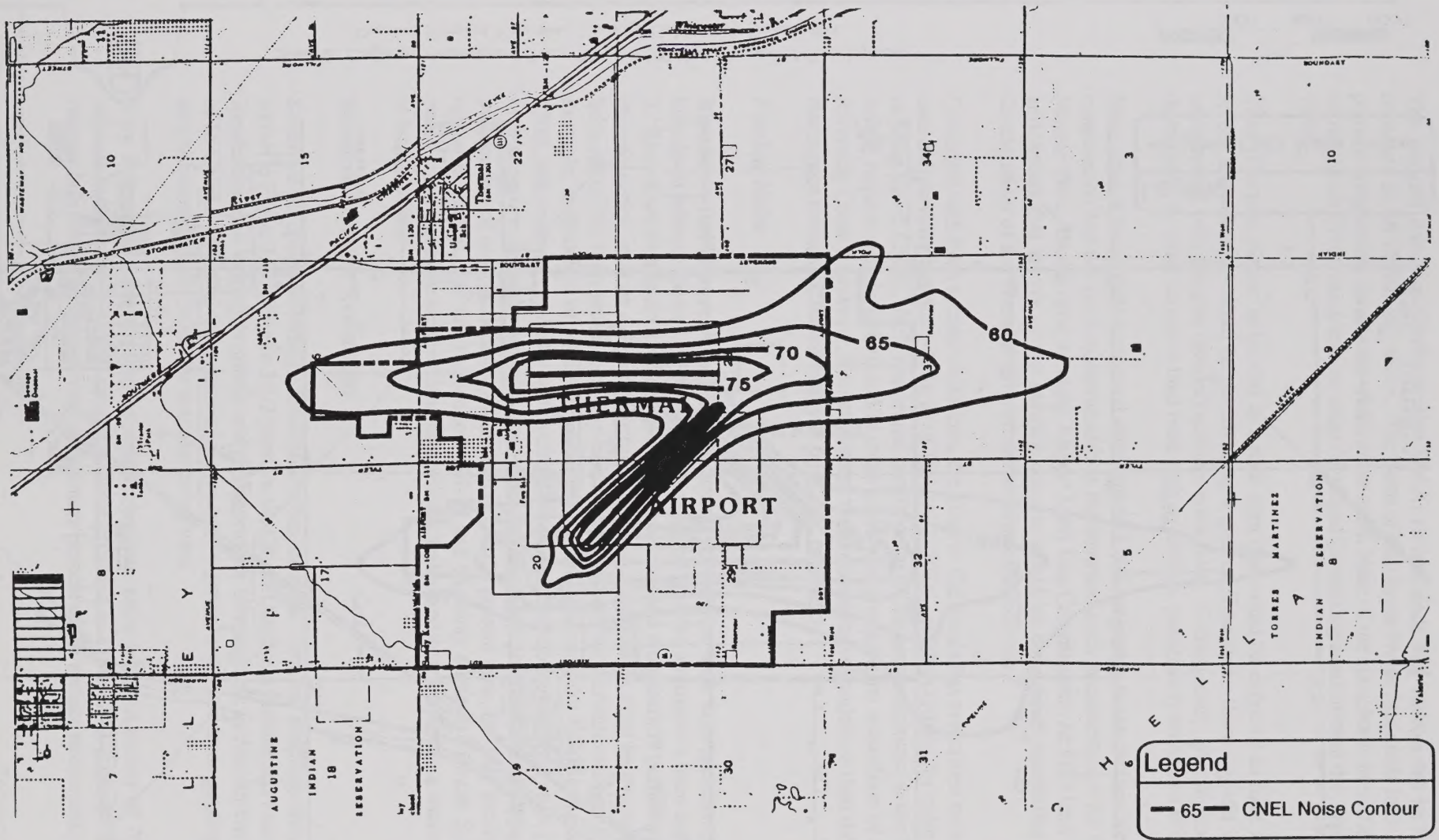
Existing Aircraft Noise

Figure 3.7-4 illustrates the Thermal Airport 1988 Noise Exposure, based upon existing conditions when the contours were developed by Coffman Associates, Inc. for the *Final EIR/EA Volume II for the Proposed Development of Thermal Airport* (June 1991). The total area encompassed within the 60 CNEL contour is approximately 1,222 acres. Of that area, 573 acres are within the 65 CNEL contour, 277 acres are located within the 70 CNEL contour, and 140 acres are within the 75 CNEL contour.

Figure 3.7-5 provides the Thermal Airport 1995 Noise Exposure, based upon an 8,500 foot Runway 17-35 and the proposed development per the Thermal Airport Master Plan Airside Alternative D. The total area encompassed within the 60 CNEL contour is approximately 1,825 acres. Of that area, 808 acres are within the 65 CNEL contour, 420 acres are located within the 70 CNEL contour, and 244 acres are within the 75 CNEL contour.

Six schools are located within a 2-mile radius of the Thermal Airport property boundary including: Coachella Valley High School, La Familia Continuation, John Kelley School, Kokell School, Peter Pendleton Elementary; and Valley View School. Of the six schools, four are located within a 2-mile radius of all existing and planned runways. Valley View and Peter Pendleton are located just outside of a 2-mile radius measured from the existing and proposed runway ends. While aircraft might fly over these facilities, the majority of these flights would be at a height of 1,000 feet or more above ground level.²

² Coachella Valley Unified School District, October 3, 1990 Correspondence by Mr. Jorge B. Gutierrez, Assistant Superintendent, Facilities and Operations, commenting on the *EIR/EA for the Proposed Development of Thermal Airport*.



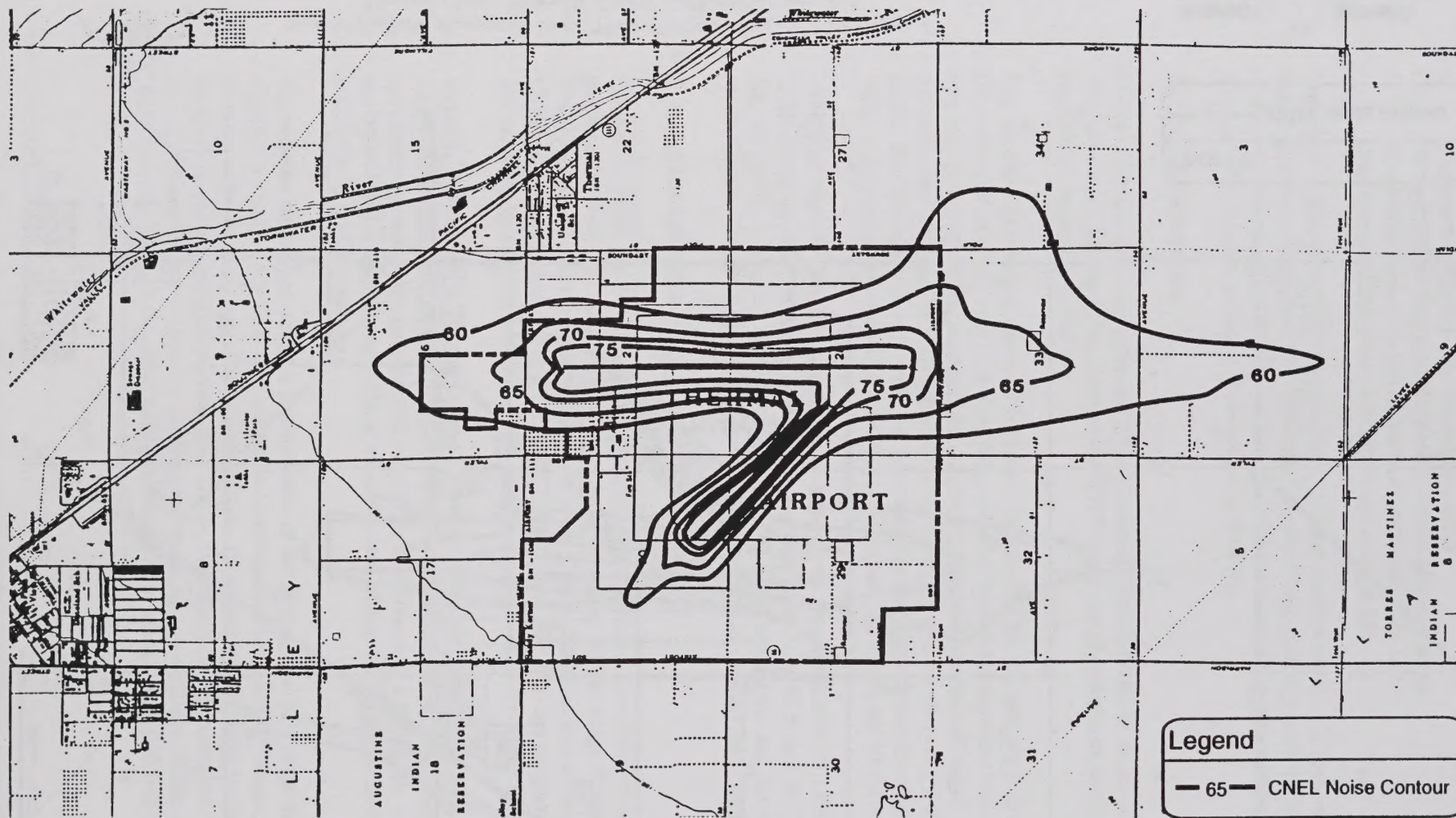
Source: Coffman Associates, Inc., "Final EJR/EA Proposed Development Thermal Airport Riverside County, California", June 1991.

Thermal Airport 1988 Noise Exposure

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Figure No. 3.7-4





Source: Coffman Associates, Inc., "Final EJR/EA Proposed Development Thermal Airport Riverside County, California", June 1991.

Feet
0 2000 4000 6000

Thermal Airport 1995 Noise Exposure-Proposed Action

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225 S. Civic Dr. Suite 1-5 Palm Springs, CA 92262

Figure 3.7-5



The Federal Aviation Administration (FAA) recommends that schools not be located within noise contours of 65 CNEL and above. The State of California Noise Standards indicate 65 CNEL as the point of acceptability for schools within urban areas. None of the six schools identified above are located within the 60 CNEL noise contour areas developed for existing conditions at the airport nor for the years 1995.

Since Thermal Airport is located in a rural area that would be expected to have lower ambient noise levels, aircraft noise could be perceived as a greater disturbance than it would in a more urbanized environment with a higher (louder) ambient noise level. Consequently, overflights could prove to be a disturbance to noise sensitive land uses such as schools, particularly when and if windows are open.

Since none of the schools are located within the 65 CNEL or greater noise contour area, noise attenuation construction has not been recommended in the environmental documentation for the Thermal Airport Master Plan. Based upon existing Airport Land Use Commission (ALUC) land use guidelines, it is anticipated that all six of the existing schools would be considered compatible with the proposed development of the Thermal Airport and anticipated airport use.³

Consistent with FAA recommendations, the State of California has prescribed noise standards for land uses surrounding airports which, as of January 1, 1986, establish criteria for noise in residential areas as being the 65 CNEL. New residential construction within areas subjected to the 65 CNEL or greater would require soundproofing and in some cases would require the acquisition of aviation easements. Riverside County, however, has established more conservative guidelines than those of the State, that discourage residential development at 60 CNEL or greater.

Pipeline Noise

Blowdown facilities are frequently operated in conjunction with high pressure pipelines. The term blowdown refers to the rapid evacuation of natural gas into the atmosphere from the pipelines that carry it. Blowdown events are an extremely rare occurrence and are generally performed only in the case of an emergency, such as a pipeline rupture. Because the pipelines must be evacuated very quickly and because of the high pressure of gas inside the pipelines, blowdown events are extremely loud. For example, at distances of 50 feet from the blowdown location, noise levels can exceed 135 dBA. The CNEL noise contours typically lie in a circle around the blowdown facility. Future projects located near high pressure gas and petroleum lines should evaluate the potential for this type of noise during the preparation of environmental documentation. At the present time, the only facility of this type in the region is located near the intersection of I-10 and Highway 62 north of Palm Springs. General Plan policy states that noise sensitive land uses will not be located near major noise sources unless mitigation is incorporated.

Sensitive Receptor Evaluation

Sensitive receptors including: residential areas, schools, libraries, hospitals, and nursing homes, are shown in Figure 3.7-3. Figure 3.7-2 provides the City of Coachella interior and exterior noise standards. Residential uses, lodging, hospitals, and classrooms are unacceptable in exterior environments in excess of 65 CNEL. Industrial and commercial uses have interior noise standards ranging from 45 CNEL for amphitheaters, to 65 CNEL for manufacturing uses.

Very few areas within the City experience ambient noise levels in excess of 70 CNEL, other than adjacent to Interstate 10. From the noise levels provided in Table 3.7-2, it can be seen that the 70 dBA contour falls within the right-of-way along ninety percent of the surface streets analyzed. By comparing

³ Source: Coffman Associates, Inc.; *Final EIR/EA Volume I & II Proposed Development Thermal Airport, Riverside County, California*; June 1991.

Figure 3.7-3 with Table 3.7-2, it can be concluded that the area with the highest potential for existing noise impacts is along Harrison Street, between Avenue 50 and Airport Boulevard. This section of Harrison Street is located adjacent to noise sensitive receptors (existing residential development), and generates noise levels ranging from 69.3 CNEL to 70.5 CNEL at 100 feet from the roadway centerline.

Future Noise Environment

Future Traffic Noise Levels

The future noise levels adjacent to Interstate 10, the SR 86 Freeway and 155 master planned surface street links were modeled to determine the location and extent of future noise problems.

As shown in Table 3.7-3, thirteen of the links modeled (8 percent) are projected to generate noise levels at a distance of 100 feet that exceed 75 CNEL upon buildout of the General Plan. Approximately 19 percent of the links evaluated (31 links) will generate noise levels at 100 feet that are between 70 CNEL and 75 CNEL. Fifty-eight links (or 35 percent) of the links modeled are projected to generate noise levels at 100 feet that were between 65 CNEL and 70 CNEL.

Thirty-eight percent of the links modeled will generate noise levels at 100 feet that are below 65 CNEL. Twenty-nine of those links (17 percent) will generate noise levels at 100 feet that range between 60 CNEL and 65 CNEL, and thirty-four (21 percent) will generate noise levels below 60 CNEL.

Of the 165 links modeled in the planning area, sixty-three (or 38 percent) were found to generate a future 70 CNEL contour that will remain within the right-of-way. Thirty-two links (19 percent) were found to generate a future 65 CNEL contour that will remain within the right-of-way. Nineteen links (12 percent) will generate 60 CNEL contours that remain within the right-of-way.

Table 3.7-4 provides a comparison of motor vehicle noise levels between current and General Plan buildout conditions. This allows the noise level changes expected adjacent to roadways in the planning area as a direct result of the proposed project to be identified. Only those links for which current traffic volumes and General Plan buildout traffic projections were available could be included in Table 3.7-4. As shown therein, the proposed General Plan will generate an audible noise increase (greater than 3.0 dBA) along forty-seven of the sixty-two roadway links compared. Fifteen potentially audible noise increases (between 1.0 and 3.0 dBA) are projected to occur. No inaudible noise increases (less than 1.0 dBA) are projected to occur adjacent to the roadway links analyzed in the planning area.

Project-related noise increases along the links evaluated will range up to 13.0 dBA along Airport Boulevard and 13.1 dBA along the SR 86 Freeway. The largest noise increases will occur along the major roadway corridors servicing areas of future development that are relatively under utilized at present. It should be noted, however, that the noise generated by motor vehicles decreases as their speed decreases. When a roadway link is extremely congested, speeds are lower and noise levels will be lower than when a free-flow condition is achieved. Consequently, some of the links that are expected to experience a significant increase in traffic volumes will exhibit lower average vehicle speeds that offset, to some extent, the noise increases that would otherwise be expected.

Table 3.7-5 provides the projected noise level at the right-of-way associated with each master planned roadway classification as well as the distances to various CNEL contours for use in determining land use compatibility for planning purposes. The values shown represent "worst case" conditions because they assume that the master planned streets are carrying daily traffic volumes equivalent to their design capacity. The values shown assume a typical 8 percent truck mix and typical average vehicle speeds by roadway classification.

Table 3.7-3
General Plan Buildout Exterior Noise Exposure
Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Interstate 10					
-W/O Auto Center Dr.	140,200	83.7	733	1577	3395
-E/O Auto Center Dr.	165,800	84.6	775	1666	3587
-W/O Dillon Road	66,200	80.0	439	945	2034
-E/O Dillon Road	45,500	78.7	360	774	1666
-E/O Smokey Gulch	25,000	76.1	243	520	1118
State Route 111					
-W/O Monroe St.	35,400	68.5	84	160	336
-W/O Jackson St.	47,500	69.8	98	193	409
-W/O Auto Center Dr.	48,700	70.5	107	220	469
-E/O Auto Center Dr.	23,300	67.1	67	136	290
Auto Center Dr./SR 111					
-N/O Avenue 46	32,400	68.6	82	169	362
-W/O Interstate 10	44,700	70.2	103	209	444
Avenue 44					
-W/O Harrison St.	12,000	64.3	R/W	90	189
-E/O Harrison St.	4,300	59.8	R/W	50	97
-E/O Dillon St.	4,500	58.8	R/W	R/W	83
Vista Del Norte					
-W/O Dillon Road	18,800	70.7	110	231	495
Grapefruit Blvd./SR 111					
-N/O Van Buren St.	40,500	73.3	162	345	742
-S/O Van Buren St.	35,800	72.8	150	320	687
-S/O Dillon Road	60,600	76.6	237	499	1069
-S/O Harrison St.	21,300	68.1	77	157	333
-S/O Avenue 50	22,300	67.4	70	141	299
-S/O Avenue 52	46,600	71.9	128	264	563
-S/O Tyler St.	18,200	67.4	70	141	299
-S/O Avenue 54	12,200	65.7	57	110	231
-S/O Airport Blvd.	11,900	65.7	57	110	231
-N/O Avenue 58	10,800	66.8	65	129	273
-N/O Avenue 62	7,400	65.2	R/W	103	215
-S/O Avenue 62	29,400	71.2	119	250	535
State Route 86 Freeway					
-S/O Interstate 10	99,500	80.6	488	1050	2261
-S/O Dillon Road	74,200	79.3	400	860	1852
-S/O Avenue 50	96,900	80.5	481	1034	2227
-S/O Avenue 52	58,000	78.3	343	738	1589
-S/O Airport Blvd.	44,100	77.1	286	614	1321

Notes: a. A.D.T. means the average daily two-way traffic volume upon buildout of the proposed GP.

b. CNEL values are at 100 feet from all roadway centerlines (see Appendix C for assumptions).

c. All distances are measured from the centerline. R/W means that the CNEL contour falls within the right-of-way.

Table 3.7-3 (Continued)
General Plan Buildout Exterior Noise Exposure
Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Harrison St.					
-S/O Avenue 44	7,600	61.1	R/W	55	118
-N/O Avenue 50	42,900	74.5	175	363	775
-S/O Avenue 50	52,600	75.4	199	416	890
-S/O Avenue 52	46,000	74.9	196	415	890
-S/O Avenue 54	42,500	75.9	227	483	1037
-S/O Airport Blvd.	30,100	74.0	179	382	821
-S/O Avenue 58	31,000	74.9	205	438	943
-S/O Avenue 60	30,900	74.9	205	438	943
-S/O Avenue 62	28,900	74.6	196	419	900
Avenue 48/Dillon Road					
-W/O Monroe St.	28,900	69.3	91	183	387
-W/O Jackson St.	29,800	69.6	95	188	396
-E/O Jackson St.	41,000	71.0	114	231	490
-W/O Van Buren St.	39,400	70.8	111	224	476
-E/O Van Buren St.	33,300	70.1	101	202	428
-E/O Grapefruit Blvd.	51,800	72.5	134	270	572
-E/O SR 86 Freeway	51,200	72.5	134	270	572
-W/O Interstate 10	33,800	70.2	103	205	434
-E/O Interstate 10	27,800	68.9	86	177	376
-S/O 44th Avenue	9,600	64.3	R/W	91	187
Avenue 50					
-W/O Monroe St.	13,900	64.9	50	99	207
-W/O Jackson St.	13,500	64.8	50	97	204
-E/O Jackson St.	16,700	66.7	65	128	269
-W/O Van Buren St.	13,500	65.8	58	112	235
-E/O Van Buren St.	17,000	66.8	65	129	273
-E/O Grapefruit St.	29,600	69.6	95	188	396
-E/O State Hwy. 86	34,900	70.3	104	208	441
-E/O Polk St.	24,400	68.7	86	165	346
-E/O Fillmore St.	27,200	69.2	91	177	373
-S/O Interstate 10	43,600	71.3	118	241	513
-N/O Interstate 10	33,200	69.7	96	199	425
Avenue 52					
-W/O Monroe St.	14,500	66.1	60	117	246
-W/O Jackson St.	18,000	67.0	67	133	282
-E/O Jackson St.	16,200	67.9	78	147	307
-W/O Van Buren St.	18,400	68.4	83	158	331
-W/O Harrison St.	27,700	70.2	103	205	434
-E/O Harrison St.	26,500	70.0	100	199	421
-E/O Grapefruit Blvd.	55,000	73.7	157	322	686
-E/O SR 86 Freeway	44,200	72.2	134	276	589

Notes: a. A.D.T. means the average daily two-way traffic volume upon buildout of the proposed GP.
b. CNEL values are at 100 feet from all roadway centerlines (see Appendix C for assumptions).
c. All distances are measured from the centerline. R/W means that the CNEL contour falls within the right-of-way.

Table 3.7-3 (Continued)
General Plan Buildout Exterior Noise Exposure
Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Avenue 52					
-E/O Polk St.	41,500	71.9	128	264	563
-E/O Fillmore St.	44,500	72.2	134	276	589
-E/O Pierce St.	39,800	71.8	127	260	554
-E/O Buchanan St.	19,800	67.5	71	143	304
Avenue 54					
-W/O Monroe St.	15,600	65.4	54	106	224
-W/O Jackson St.	17,300	65.8	56	112	238
-E/O Jackson St.	9,400	65.5	62	107	214
-W/O Van Buren St.	16,700	68.0	79	149	311
-W/O Harrison St.	17,800	68.3	82	156	326
-E/O Harrison St.	22,900	69.4	93	183	385
-W/O Grapefruit Blvd.	13,000	66.9	71	128	264
-E/O Grapefruit Blvd.	20,200	68.3	79	163	348
-E/O SR 86 Freeway	16,800	65.7	56	111	234
-E/O Fillmore St.	10,100	62.3	R/W	66	142
Airport Blvd.					
-W/O Monroe St.	11,600	65.1	R/W	101	211
-W/O Jackson St.	10,700	64.8	R/W	97	202
-E/O Jackson St.	13,500	67.1	72	132	272
-W/O Van Buren St.	16,500	67.9	78	147	307
-W/O Harrison St.	20,100	68.8	87	167	351
-E/O Harrison St.	20,100	68.8	87	167	351
-W/O Polk St.	17,300	68.1	80	152	316
-W/O Grapefruit Blvd.	27,000	70.1	101	202	428
-E/O Grapefruit Blvd.	20,600	68.9	88	170	357
-E/O SR 86 Freeway	24,700	68.4	80	164	349
-E/O Fillmore St.	18,400	67.1	68	135	286
-E/O Pierce St.	14,500	66.1	60	117	246
-E/O Buchanan St.	15,200	66.3	61	120	253
Avenue 58					
-W/O Monroe St.	1,600	55.5	R/W	R/W	54
-W/O Jackson St.	800	52.5	R/W	R/W	R/W
-E/O Jackson St.	900	53.0	R/W	R/W	R/W
-W/O Harrison St.	900	53.0	R/W	R/W	R/W
-E/O Pierce St.	100	42.3	R/W	R/W	R/W
Avenue 60					
-W/O Monroe St.	4,600	58.9	R/W	R/W	85
-W/O Jackson St.	100	42.3	R/W	R/W	R/W
-E/O Harrison St.	100	42.3	R/W	R/W	R/W

Notes: a. A.D.T. means the average daily two-way traffic volume upon buildout of the proposed GP.
b. CNEL values are at 100 feet from all roadway centerlines (see Appendix C for assumptions).
c. All distances are measured from the centerline. R/W means that the CNEL contour falls within the right-of-way.

Table 3.7-3 (Continued)
General Plan Buildout Exterior Noise Exposure
Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c		
			70 CNEL	65 CNEL	60 CNEL
Avenue 62					
-W/O Jackson St.	1,200	55.3	R/W	R/W	55
-E/O Jackson St.	6,900	62.9	R/W	75	152
-W/O Harrison St.	6,100	62.3	R/W	70	139
-E/O Harrison St.	200	47.5	R/W	R/W	R/W
-E/O Tyler St.	200	47.5	R/W	R/W	R/W
-E/O Polk St.	300	49.3	R/W	R/W	R/W
-W/O Pierce St.	400	50.5	R/W	R/W	R/W
-W/O Grapefruit Blvd.	500	51.5	R/W	R/W	R/W
-E/O Grapefruit Blvd.	22,200	68.0	76	154	328
-W/O Buchanan St.	2,700	56.6	R/W	R/W	60
Monroe Street					
-N/O SR 111	16,300	65.6	55	109	231
-N/O Avenue 48	12,900	64.6	R/W	94	198
-N/O Avenue 50	9,600	62.1	R/W	64	138
-N/O Avenue 52	9,800	64.4	R/W	92	190
-N/O Avenue 54	8,000	63.5	R/W	81	166
-N/O Airport Blvd.	5,500	61.9	R/W	66	131
-S/O Airport Blvd.	4,600	61.1	R/W	60	117
-N/O Avenue 60	3,800	60.3	R/W	55	104
-N/O Avenue 62	4,200	60.7	R/W	57	110
Jackson Street					
-N/O SR 111	24,200	68.6	84	165	348
-N/O Avenue 48	25,000	68.3	78	164	352
-N/O Avenue 50	13,700	65.8	56	112	238
-N/O Avenue 52	15,500	66.4	62	122	257
-N/O Avenue 54	11,100	64.9	R/W	99	205
-N/O Airport Blvd.	14,700	66.2	61	119	250
-N/O Avenue 58	7,200	63.1	R/W	77	157
-N/O Avenue 60	7,600	63.3	R/W	79	161
-N/O Avenue 62	4,200	60.7	R/W	57	110
Calhoun Street					
-N/O Avenue 48	4,900	59.2	R/W	R/W	88
-N/O Avenue 50	7,700	61.2	R/W	56	120
-N/O Avenue 52	3,500	57.7	R/W	R/W	70
-N/O Avenue 54	3,300	57.5	R/W	R/W	68
-N/O Airport Blvd.	3,900	58.2	R/W	R/W	76
Van Buren Street					
-N/O Avenue 48	7,800	63.3	R/W	79	163
-N/O Avenue 50	25,600	68.5	81	168	359
-N/O Avenue 52	21,200	67.7	72	149	317
-N/O Avenue 54	13,300	65.6	55	109	231

Notes: a. A.D.T. means the average daily two-way traffic volume upon buildout of the proposed GP.

b. CNEL values are at 100 feet from all roadway centerlines (see Appendix C for assumptions).

c. All distances are measured from the centerline. R/W means that the CNEL contour falls within the right-of-way.

Table 3.7-3 (Continued)
General Plan Buildout Exterior Noise Exposure
Adjacent to Planning Area Roadways

Roadway	A.D.T. ^a (Veh/Day)	CNEL ^b @ 100 Feet	Distance to Contours (Feet) ^c 70 CNEL 65 CNEL 60 CNEL		
Van Buren Street					
-N/O Airport Blvd.	5,200	61.6	R/W	62	126
-N/O Avenue 58	800	53.2	R/W	R/W	R/W
-N/O Avenue 60	800	53.2	R/W	R/W	R/W
-N/O Avenue 62	800	51.3	R/W	R/W	R/W
Polk Street					
-S/O Dillon Road	48,700	72.6	141	293	626
-N/O Avenue 50	38,800	71.6	123	252	537
-N/O Avenue 52	5,400	59.6	R/W	44	94
Tyler Street					
-N/O Avenue 54	31,700	69.5	93	193	412
-N/O Airport Blvd.	19,500	66.4	61	123	260
-N/O Avenue 62	100	42.3	R/W	R/W	R/W
Fillmore Street					
-N/O Avenue 52	7,800	61.2	R/W	56	120
-N/O Avenue 54	7,300	60.9	R/W	54	115
-N/O Airport Blvd.	7,900	61.3	R/W	57	122
-N/O Avenue 60	1,700	54.6	R/W	R/W	R/W
-N/O Avenue 62	1,700	54.6	R/W	R/W	44
-S/O Avenue 62	2,200	55.7	R/W	R/W	52
Pierce Street					
-N/O Avenue 54	10,100	63.5	R/W	81	168
-N/O Airport Blvd.	8,200	62.6	R/W	71	147
-N/O Avenue 62	3,400	57.6	R/W	R/W	69
-S/O Avenue 62	400	48.3	R/W	R/W	R/W
Buchanan Street					
-N/O Avenue 58	900	51.8	R/W	R/W	R/W
-N/O Avenue 60	900	51.8	R/W	R/W	R/W
-N/O Avenue 62	2,700	56.6	R/W	R/W	60

Notes: a. A.D.T. means the average daily two-way traffic volume upon buildout of the proposed GP.

b. CNEL values are at 100 feet from all roadway centerlines (see Appendix C for assumptions).

c. All distances are measured from the centerline. R/W means that the CNEL contour falls within the right-of-way.

Table 3.7-4
Projected Increase in Motor Vehicle Noise

Roadway Link	CNEL at 100 Feet ^a		Projected Increase (dBA)
	Existing Condition	General Plan Buildout	
Interstate 10			
-W/O Auto Center Dr.	76.0	83.7	7.7
-E/O Auto Center Dr.	75.7	84.6	8.9
-W/O Dillon Road	73.6	80.0	6.4
-E/O Dillon Road	73.7	78.7	5.0
-E/O Smokey Gulch	73.7	76.1	2.4
State Route 86			
-S/O Interstate 10	67.5	80.6	13.1
-S/O Airport Blvd.	65.9	77.1	11.2
Grapefruit Blvd./SR 111			
-N/O Van Buren St.	71.2	73.3	2.1
-S/O Van Buren St.	71.3	72.8	1.5
-S/O Dillon Road	72.5	76.6	4.1
-S/O Harrison St.	64.4	68.1	3.7
-S/O Avenue 50	64.5	67.4	2.9
-S/O Airport Blvd.	64.0	65.7	1.7
-N/O Avenue 58	65.5	66.8	1.3
Harrison Street			
-N/O Avenue 50	70.5	74.5	4.0
-S/O Avenue 50	70.5	75.4	4.9
-S/O Avenue 52	69.7	74.9	5.2
-S/O Avenue 54	69.7	75.9	6.2
-S/O Avenue 58	69.3	74.9	5.6
-S/O Avenue 60	70.3	74.9	4.6
Avenue 48/Dillon Road			
-W/O Jackson St.	63.7	69.6	5.9
-E/O Jackson St.	61.9	71.0	9.1
-E/O Van Buren St.	62.3	70.1	7.8
-E/O Grapefruit Blvd.	64.4	72.5	8.1
-W/O Interstate 10	63.0	70.2	7.2
-E/O Interstate 10	60.8	68.9	8.1
Avenue 50			
-W/O Monroe St.	62.7	64.9	2.2
-W/O Jackson St.	63.1	64.8	1.7
-W/O Van Buren St.	63.3	65.8	2.5
-E/O Van Buren St.	64.0	66.8	2.8
-E/O Grapefruit Blvd.	60.1	69.6	9.5
Avenue 52			
-W/O Monroe St.	63.2	66.1	2.9
-W/O Jackson St.	62.0	67.0	5.0
-E/O Jackson St.	62.4	67.9	5.5
-W/O Harrison St.	63.4	70.2	6.8
-E/O Harrison St.	61.7	70.0	8.3
-E/O Grapefruit Blvd.	61.2	73.7	12.5

a. All distances are measured from the centerline.

Table 3.7-4 (Cont.)
Projected Increase in Motor Vehicle Noise

Roadway Link	CNEL at 100 Feet ^a		Projected Increase (dBA)
	Existing Condition	General Plan Buildout	
Avenue 54			
-W/O Harrison St.	55.9	68.3	12.4
-E/O Harrison St.	57.1	69.4	12.3
-W/O Grapefruit Blvd.	55.0	66.9	11.9
-E/O Grapefruit Blvd.	56.6	68.3	11.7
Airport Blvd.			
-W/O Monroe St.	52.9	65.1	12.2
-W/O Jackson St.	57.7	64.8	7.1
-E/O Jackson St.	57.4	67.1	9.7
-W/O Harrison St.	60.6	68.8	8.2
-E/O Harrison St.	60.7	68.8	8.1
-W/O Polk St.	61.6	68.1	6.5
-W/O Grapefruit Blvd.	57.1	70.1	13.0
-E/O Grapefruit Blvd.	57.8	68.9	11.1
Avenue 62			
-E/O Grapefruit Blvd.	57.1	68.0	10.9
Monroe Street			
-N/O Avenue 54	61.0	63.5	2.5
-S/O Airport Blvd.	58.9	61.1	2.2
Jackson Street			
-N/O Avenue 52	62.6	66.4	3.8
-N/O Airport Blvd.	59.9	66.2	6.3
-N/O Avenue 60	57.7	63.3	5.6
-N/O Avenue 62	57.4	60.7	3.3
Calhoun Street			
-N/O Avenue 54	55.5	57.5	2.0
Van Buren Street			
-N/O Avenue 50	56.3	68.5	12.2
-N/O Avenue 52	57.2	67.7	10.5
-N/C Avenue 54	57.6	65.6	8.0
-N/O Airport Blvd.	57.2	61.6	4.4
Pierce Street			
-N/O Avenue 62	55.0	57.6	2.6

a. All distances are measured from the centerline.

Table 3.7-5
Design Noise Levels Adjacent to Master Planned Roadways

Classification	Typical Lane Configuration	Capacity ^a (Veh/Day)	CNEL Value At		Distance to CNEL Contours (Ft.) ^d		
			R/W ^b	100 Feet ^c	70 dBA	65 dBA	60 dBA
Enhanced Major Major Arterial Primary Arterial	8-Lane Divided	66,500	78.3	74.5	175	363	775
	6-Lane Divided	50,000	77.8	72.7	143	298	636
	4-Lane Divided	33,500	74.4	69.7	96	199	425
Secondary Arterial Major Collector Minor Collector	4-Lane Divided	30,000	73.4	68.2	77	160	343
	4-Lane Undivided	25,000	72.2	66.4	59	123	263
	2-Lane Undivided	15,000	0	0	0	0	0

a. A.D.T. is the average daily two-way traffic volume at the design capacity (upper limit of LOS D) associated with each roadway classification.

b. Assumes: (1) an 8 percent truck mix; (2) a 144-foot R/W with 50 mph average travel speed for enhanced major arterials; (3) an 120-foot R/W with a 50 mph average travel speed for major arterials; (4) an 110-foot R/W with a 45 mph average travel speed for primary arterials; (5) an 100-foot R/W with a 40 mph average travel speed for secondary arterials; and (6) an 88-foot R/W with a 35 mph average travel speed for collectors.

c. Values are at 100 feet from roadway centerline.

d. Assumes a sound attenuation rate of 4.5 dB per doubling of distance with all distances measured from the roadway centerline.

Future Railroad Noise

Contours for long-term conditions require projections of future rail use, speed, time of use, quality of track, etc. Since the Southern Pacific Transportation Company has no projections for future operations, it is not possible at this time to accurately predict future conditions. Proposed developments near the main railroad line should be required to address noise impacts from the railroad on the proposed project.

Future Airport Noise

Figure 3.7-6 provides the Thermal Airport 2010 Noise Exposure, based upon activity forecasts in the Thermal Airport Master Plan (including a limited number of commercial operations) with Runway 17-35 extended to 10,000 feet, and with the development proposed per the Thermal Airport Master Plan Airside Alternative D. The total area encompassed within the 60 CNEL contour is approximately 2,008 acres. Of that area, 878 acres are within the 65 CNEL contour, 440 acres are located within the 70 CNEL contour, and 206 acres are located within the 75 CNEL contour.

None of the six schools identified in on Figure 3.7-6 are located within the 60 CNEL noise contour areas projected for year 2010 conditions at Thermal Airport. Since the primary runway is oriented to the north-south, the areas with the highest projected noise levels are planned primarily for commercial and industrial development. Future aircraft noise levels above 60 CNEL are not oriented over the existing community of Thermal or the urban areas of the City of Coachella.

The Final EIR/EA for the Thermal Airport Master Plan indicates that five permanent residential units and three mobile homes are currently located within the year 2010 projected 60 CNEL contour shown in Figure 3.7-6. One mobile home and two permanent homes are located just north of Airport Boulevard. The other residential area is located 4,000 feet north of Airport Boulevard and 800 feet east of the extended centerline of Runway 35.

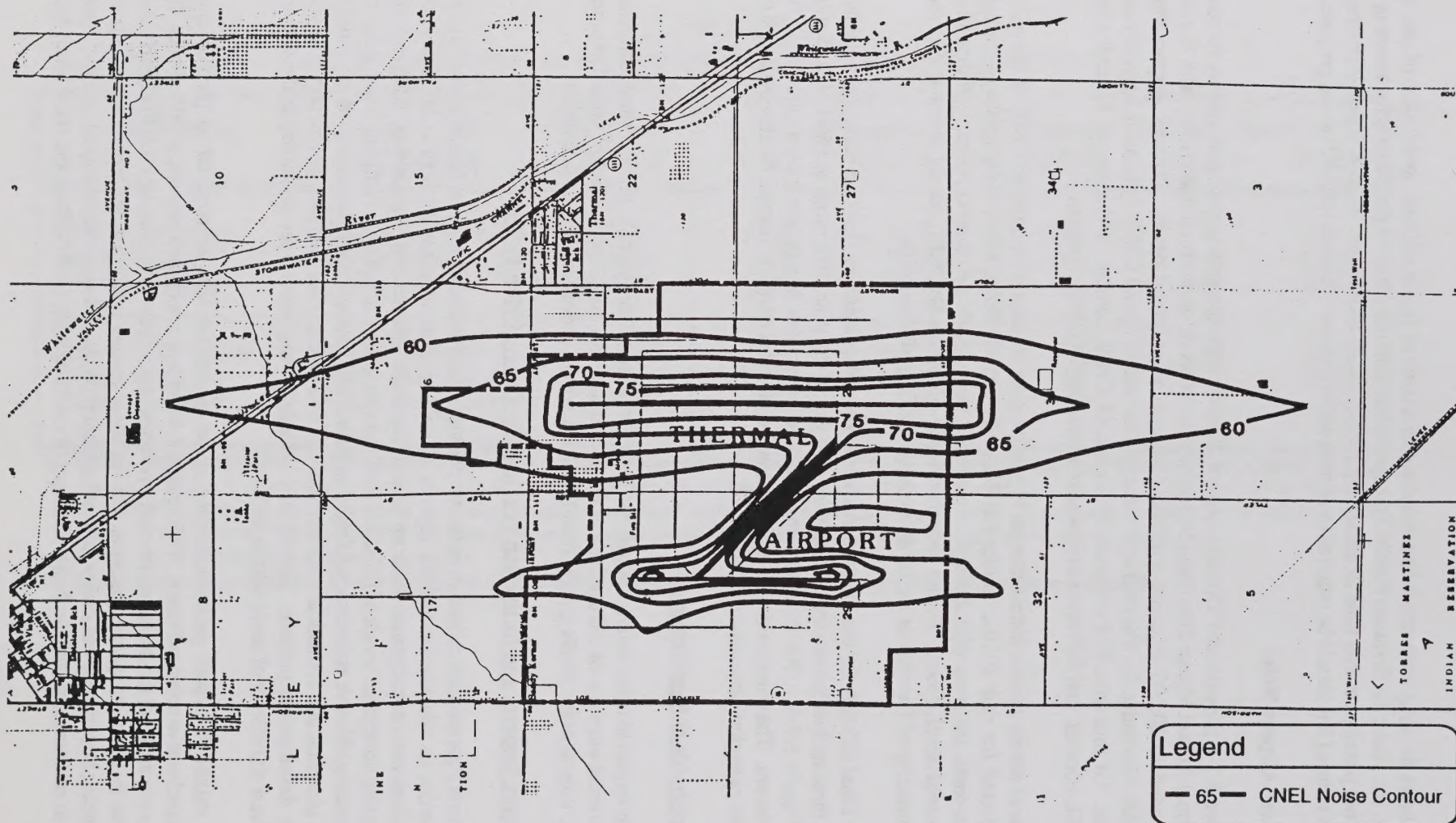
Thresholds of Significance

With respect to noise issues, impacts are considered significant if the General Plan would result in long term noise increases of 3.0 decibels or more over ambient noise conditions and would expose sensitive land uses to noise levels greater than 65 CNEL without adequate sound attenuation.

Project Impacts and Mitigation Provided by General Plan Policy

General Plan policies related to noise are contained in the Environmental Hazards and Safety Element. In order to address the various aspects of noise within the planning area at buildout, policies and implementation programs focus on identifying noise sources and determining noise exposure levels; adopting acceptable levels of noise for land use categories; adopting a comprehensive noise ordinance; promoting effective enforcement of existing federal and state noise standards; requiring proper acoustical site planning and acoustical construction; and evaluating noise analyses which have been required for new development projects. Specifically, the following policies are contained in the General Plan to address the effects of noise within the City.

To establish overall policy regarding noise issues, the City is required to prepare and adopt a comprehensive noise ordinance. To implement noise policies on new development projects, the General Plan requires that the design review and environmental review processes be used to identify and mitigate noise impacts on specific projects. During these review processes, the Engineering Department and Planning Department will review all development projects and noise reports to ensure that these projects are in conformance with the Noise Element of the Coachella General Plan and the Airport Master Plan.



Source: Coffman Associates, Inc., "Final EJR/EA Proposed Development
Thermal Airport Riverside County, California", June 1991

Feet
0 2000 4000 6000

Thermal Airport 2010 Noise Exposure-Proposed Action

Smith, Peroni & Fox, Planning Consultants, Inc.
225 S. Civic Dr. Suite 1-5 Palm Springs, CA 92262

Figure 3.7-6



In order to determine when noise studies will be required, the General Plan contains a table which serves as a guideline as to when and where roadway noise may exceed acceptable levels. In areas which may exceed these thresholds, more specific noise analysis will be required and mitigation measures developed as appropriate. Construction of noise sensitive land uses such as residential areas will only be allowed if it is demonstrated with a noise study that the exterior and interior noise environment will be mitigated to achieve the noise standards in the General Plan.

The General Plan addresses roadway noise via numerous policies. Since truck noise is a significant contributor to roadway noise levels, General Plan policy requires the City to update the truck route plan to reduce vehicular noise in sensitive areas. To address the effects of noise at the receptor, General Plan policy states that the City will require noise control plans for new development within the 60 CNEL contour of arterial and collector streets and that the City will allow only noise tolerant development in areas irrevocably committed to noise producing land uses including transportation corridors, railroads, and the Thermal Airport. Existing sensitive land uses, primarily residential areas along Harrison Street and Avenue 52 (see Figure 3.7-3) may be exposed to increased noise levels due to traffic increases on those roadways. Because the uses are existing, noise studies and mitigation cannot be incorporated into the project approval and significant impacts could result.

Additional Mitigation and Unmitigable Impacts

General Plan implementation is anticipated to result in a general increase in ambient noise levels within the City greater than 3.0 decibels at numerous locations and in potential exposure of existing residential areas to noise levels greater than 65 CNEL. These are considered to be unmitigable significant adverse impacts of plan implementation.

3.8 Visual and Aesthetic Resources

Existing Conditions

The topography of the Study Area ranges in elevation from 1,400 feet in the Mecca Hills to the east, to about 160 feet below sea level south of Thermal. Slope percentages in the Mecca Hills were calculated based on the U.S.G.S. Mecca and Thermal Canyon Quadrangle Maps. Of the approximately 13,000 acre Mecca Hills area, approximately 3 percent contains slopes of 25 percent or greater, about 8 percent contains slopes between 15 and 25 percent, and the remainder of the area is between 0 and 15 percent. With the exception of the Mecca Hills, however, most of the Study Area is relatively flat, sloping gently from northwest to southeast.

Scenic resources which can be seen from the study area include the Santa Rosa Mountains to the west and south of the Study Area; the Mecca Hills to the east; and the Indio Hills to the north beyond which is the Little San Bernardino Mountains in the distance (see Figure 2.4-2, Regional Map). The visual environment also includes substantial land in agricultural production which provides a contrast with the natural desert north and east of the Study Area (Refer to Figure 3.1-1, Existing Land Use)

Valuable aesthetic resources are highly subjective and open to interpretation by the individual viewer. However, the Coachella Valley Master Environmental Assessment (MEA) assigns scenic values to various areas of the Coachella Valley based on the following criteria: High scenic resources are those with striking or unique characteristics such as the San Jacinto Mountains which form the western boundary of the Valley. Medium scenic resources are alluvial fans and less prominent alluvial and mountain structures. Low scenic resources can be characterized by non-descript mountains and valleys where natural desert terrain offers minimal scenic merit.

Based on the above referenced MEA, the Study Area is within the Coachella Valley Scenic Resource area (#9) which is given Low scenic value; the East Little San Bernardino Bajada (#14) which is given Low scenic value; the Mecca Hills North (#17) which is given Low scenic value; and Urban Area (#33) which is not assigned any scenic value. Therefore, according to the MEA, the overall Study Area is considered to have Low scenic value. However, as discussed above, views of surrounding mountains with High (Santa Rosas) and Medium (Little San Bernardinos) scenic value can be seen from the Study Area.

Key viewpoints within the Study Area include major travel corridors such as Interstate-10 and Highways 86 (Harrison and Expressway) and 111. Roadways function as visual corridors, opening up unobstructed views of the surrounding mountains. Other focal points for scenic vistas include the higher elevations in the eastern portion of the Study Area where development can potentially occur.

The State Scenic Highways Program seeks to identify, protect and enhance State scenic resources with assistance from local, County and State agencies. Although no highways in the planning area are currently included on the *State Scenic Highway System List of Eligible and Officially Designated Routes* (Revised March 31, 1993), Riverside County utilizes the same criteria established in the State Scenic Highways Program for determining eligibility of routes and corridors as scenic highways.¹

A corridor study must be completed by the Riverside County Planning Department and approved by the State Director of Transportation, before a route can be designated as an Official County Scenic Highway. Although there are currently no Official County Scenic Highways in the planning area, the Riverside County Scenic Highways Element includes two Eligible County Scenic Highways within the planning

¹ County of Riverside; *Comprehensive General Plan*; 4th Edition; Reprinted 1994.

area. These include Interstate-10 (from the junction with Highway 62 to the Colorado River) which provides a panoramic view of the desert and the encircling mountains as well as agricultural and resort areas and Dillon Road (north of Interstate-10 to Palm Drive).

The visual environment of the project area also includes man-made features including parks, schools, commercial, residential, industrial buildings and infrastructure such as utility lines, highways and railroad facilities. These elements interact with the natural environment to either enhance or diminish aesthetic qualities. The scale, density, and color of man-made elements can block views or cause visual clutter which distracts the viewer. In the Study Area, urban uses are generally limited to one-story single-family, and two-story multi-family residential uses, retail "strip" centers, and scattered commercial and industrial uses such as restaurants, car dealers and food packing and shipping operations. These uses are generally concentrated in the area of the City south of the Southern Pacific rail line and Grapefruit Boulevard (Highway 111) and north of Avenue 54. Other urban uses in the project area include warehousing and shipping facilities, small markets, scattered residential uses, and the Thermal Airport and nearby community of Thermal. Most of these uses are clustered together and are relatively small in scale and mass (generally under two stories with the exception of some warehousing facilities and water towers) and fit in with the character of surrounding desert communities, and do not obstruct any significant scenic vistas.

Another aesthetic concern relates to nighttime lighting and glare due to reflective surfaces during the day. Current sources of light and glare are the urbanized portions of the study area as well as major highways such as Highway 111, Interstate-10, and Highway 86 Expressway. Most cities in the Valley have for many years maintained a "dark sky" policy limiting night lighting so as not to interfere with operation of the Mount Palomar Observatory in San Diego County. However, in recent years an increase in development along with fear of crime has resulted in more extensive use of night lighting which can diminish views of the sky². Light and glare is not generally a problem in the Study Area due to the lack of extensive street lighting, large industrial and commercial developments, and multi-story buildings with glass or mirrored facades. The exception is the use of skylights at casinos located on tribal land in the northern part of the Study Area.

Thresholds of Significance

Visual and aesthetic impacts are somewhat subjective and vary from person to person. For the purposes of this EIR, visual impacts are considered significant if the General Plan would cause views of significant visual landmarks to be blocked, would allow project approvals which have a negative visual appearance, would cause significant natural landforms to be altered by grading or would encourage the introduction of lighting sources which do not control the effects of light and glare on adjacent properties.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan will alter the visual character of the Study Area in that it will result in increased urban growth. This increase in urban growth could be perceived as a negative aesthetic impact in comparison with Study Area's current dominance by agriculture. However, the General Plan contains policies under the Urban Design Element which ensure that new development conforms to common architectural standards which will both enhance the visual quality of the City and mitigate any potential adverse effects of urban growth. In addition, the proposed General Plan diagram designates approximately 14,500 acres (about 2/3 of existing agriculture) for continued agricultural production, thus offsetting some of the visual effects of converting agriculture to urban uses. Other agricultural areas

² The Battle of Light and Darkness, *The Desert Sun*, May 12, 1996.

which are converted to urban uses are subject to an agricultural to urban transition overlay which applies design incentives to retain agricultural elements within new development projects. Consequently, no adverse impacts are anticipated with respect to the visual character of the Study Area.

The General Plan does not propose uses which would substantially obstruct views of surrounding scenic hills and mountains. The more intense uses such as commercial and industrial are generally located along Highway 111 and Highway 86 corridors. The majority of the outlying portions of the Planning Area are low intensity uses including Very Low Density Residential and Agriculture which would not obstruct views (See General Plan Land Use Policy Diagram, Figure 3.1-5). Additionally, the General Plan and Zoning Code does not allow uses at such a mass and scale which would eliminate views of the scenic resources (i.e., Mecca Hills, Indio Hills, Santa Rosa Mountains) surrounding the Study Area. For example, the maximum allowable height for industrial and commercial buildings is 35 feet within 150 feet of residential uses and 50-feet for all other areas. Therefore, this potential impact is not considered significant.

Although the MEA describes the Mecca Hills area as having Low scenic value, hillside development can have a negative visual impact if not properly designed since it can be seen from various locations within the Planning Area. The Land Use Diagram designates the Mecca Hills as Open Space, Specific Plan, and Very Low Density Residential. Policies in the Land Use Element limit development on slopes over 20 percent. These policies also recommend the development of a Hillside Construction Ordinance which will guide future development in hillside areas.

Policy Guidelines in the Urban Design Element are: to create a unique total vision for the City which is founded in its strong history and tradition; to create the framework for quality that is a natural elegant environment which will discourage mediocrity and can, in itself, become an identifying characteristic of the City; and to create a panoramic backdrop for entertainment - a frame of reference which leads from one form of entertainment to another without discomfort or offense.

Specific policies in the Urban Design Element of the General Plan are included to enhance the visual quality of the urban environment within Coachella. These include specific policies relating to the design of new residential, commercial, and industrial projects, and to areas of specific design focus including the Downtown Commercial District and the proposed Entertainment Area and Plaza Mayor. Specific design policies relate to architectural building elements, streetscapes, pedestrian spaces and corridors, and the establishment of landscape guidelines. Policies also encourage the undergrounding of utilities whenever possible. The Circulation Element contains design policies which designate specific roadways within the City as visual gateways and image corridors with associated design guidelines to create an attractive visual image of the City from key roadways and entry points. General Plan policy also states the City's intention to coordinate with Riverside County regarding the designation of any scenic highways in or near the City. Consequently, implementation of the General Plan will result in an enhancement of the visual and aesthetic quality of the manmade environment within the City.

As discussed above, light and glare is not currently a major problem in the study area due to the lack of extensive street lighting, large industrial developments, and multi-story buildings with glass or mirrored facades. Urban development associated with General Plan implementation will result in new sources of artificial light for exterior and interior lighting for buildings, signage, walkways, landscaped areas, parking lots and street lighting. The General Plan policy recommends that lighting should be oriented downward wherever possible, the use of motion sensors for lighting should be incorporated where feasible, and lights should be shielded to minimize light spill. Therefore, with the possible exception of casino lighting on tribal land which is not subject to City regulations, potential impacts associated with light and glare will not be significant. Aside from glare along roadways associated with increased nighttime traffic, design policies in the proposed General Plan would preclude building materials which cause a substantial increase in daytime glare such as extensive use of glass and mirrors. Therefore daytime impacts due to glare are not considered significant with policy implementation.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to visual and aesthetic resources are anticipated as a result of General Plan implementation.

3.9 Historic, Archaeologic, and Paleontologic Resources

In April 1996, a cultural resources study was completed for the project area by CRM TECH, a historical and archaeological consulting firm. A historical/archaeological records search was conducted at the Eastern Information Center (EIC) at the University of California, Riverside (UCR). The EIC is part of the statewide system of repositories for cultural resource records overseen by the Office of Historic Preservation and administered by the California State Department of Parks and Recreation. Maps and reports were examined at EIC to determine the presence of archaeological sites, historical and previous surveys of cultural resources in and around the study area. The findings of this records search is summarized below and the entire technical report is contained in this document as Appendix G.

Existing Conditions

History of Coachella

The Cahuilla Indians are the first known human inhabitants of the Coachella Valley. These peoples have been divided by anthropologists into three groups based on their geographic setting. These groups include the Pass Cahuilla of the Banning-Beaumont area, the Mountain Cahuilla from the San Jacinto and Santa Rosa Mountains and Cahuilla Valley, and the Desert Cahuilla from the Coachella Valley as far south as the Salton Sea.

The Cahuilla lived in family groups, or clans that were in turn grouped within two main divisions. People from clans in one division had to marry into clans from the other division. Interaction between clans was limited to trade, intermarriage, and performing ceremonies. Individual clans had villages, or central places, and territories they considered theirs for purposes of hunting game, gathering food and other necessary resources.

The Desert Cahuilla had many villages throughout the Coachella Valley, occupied by varying clan groups. They subsisted on a variety of planted crops as well as hunting and gathering. Population estimates prior to European contact range from 3,600 to as high as 10,000 persons. However, the Cahuilla population was decimated during the 1800's due to European diseases, most notably smallpox, for which they had no immunity.

In the mid- 1850's, the first official U. S. land survey in Southern California, conducted by U. S. Deputy Surveyors Henry Washington and John La Croze, noted eight Indian villages or Indian *rancherías* within or just outside the boundaries of the study area, presumably occupied by the Desert Cahuilla people.

In the same surveys, Washington and La Croze also observed a number of roads and trails crisscrossing the study area, connecting the villages and *rancherías* to one another. Two of these roads and trails, both traversing through the study area in a northwest-southeast direction, appear to have been the main thoroughfare for traffic in the vicinity. One adhered to the base of the Santa Rosa Mountains, and passed through the study area in the southwestern corner while the other, identified as the road from Palma Seca to Cavasones Village, was recorded along the Whitewater River bed, running directly through the center of the study area. Palma Seca, another Indian village, was located at the site of the present-day city of Indian Wells. Judging from their courses, these two main roads that Washington and La Croze described were undoubtedly two branches of the ancient Cocomaricopa Trail.

In 1862, this ancient Indian trade route was "rediscovered" by William David Bradshaw, and soon became known as the highly legendarized Bradshaw Trail. In the aftermath of the La Paz gold rush on the Colorado River, this "new" trail between Southern California and Arizona gained instant popularity. A stagecoach line was put into service on the Bradshaw Trail within the same year, and over the next few years, a number of stagecoach and freight companies competed for the flow of passengers and goods traveling between coastal Southern California and the La Paz gold fields. Many colorful western legends

were born on this trail before traffic diminished sharply in the late 1870s. After 1877, with the depletion of the La Paz gold mines and the expansion of the railroad into the desert, passenger, mail and freight service was gradually discontinued over the Bradshaw Trail. By the late 1880s, the trail served little more than the needs of local ranchers.

The railroad that helped bring about the downfall of the Bradshaw Trail was the Southern Pacific Company's Coachella Valley line, constructed in 1876-1877. Paralleling the Whitewater River through the study area, the Southern Pacific Coachella Valley line was part of a second transcontinental railroad thoroughfare authorized by the Congress in 1866, which ultimately came to be known as the "Sunset Route".

As a direct result, development of the railroad brought waves of Euroamerican settlers to the Coachella Valley, and a series of new communities sprang up along the tracks. In 1901, a land and water company developed a townsite at the railroad siding formerly known as Woodspur, and a new name for the locale, Coachella, was coined from Coahuilla and Conchilla, two names that had been used alternatively for the Coachella Valley. The next year, H. W. Cottle & Co. subdivided another townsite near the Southern Pacific station of Kokell, and when the townsite was sold to Horace Adin Green later that year, the name was changed to Thermal. By the early 20th century, Euroamerican settlements, featuring cultivated fields, property-line fences, irrigation ditches, and settlers' homes, had replaced the Indian villages and *rancherías* to become the prevailing cultural landscape in the study area. These settlements were scattered throughout the level western portion of the study area, which lies today south and west of the Coachella Canal.

By the early 1940s, the study area showed significant growth in population and agriculture. These developments reflected the fast-growing date palm industry in the Coachella Valley, which had by then become the main agricultural staple in the region. Date palms were first introduced into the Indio area in 1904 by the U. S. Department of Agriculture on an experimental basis. After the mid-1910s, growers in the Coachella Valley adopted the new cash crop with great enthusiasm, and the region's famed date palm industry was firmly established.

In 1928, the Congress passed the Boulder Canyon Project Act, directing the federal government to build the All-American Canal to replace the old, inadequate and problematic Imperial Canal as the centerpiece of irrigation system in the Imperial Valley. Although completed in 1941, the All-American Canal was not functional until the end of the decade due to delays caused by the Second World War. Since that time, it has served as the main water supply for residents of the Coachella Valley.

The completion of the Coachella Canal had a dramatic impact on the growth of the Coachella area. Notably, this mid-century boom took place in the western portion of the study area south of the Coachella Canal, while the eastern portion north of the Canal essentially remained untouched by civilization, with the exception of limited mining and quarrying activities along the base of the Mecca Hills that had been taking place since the 1940s.

At some time prior to 1918, the Coachella Valley Water District used the bed of the intermittent Whitewater River for the construction of the Coachella Valley Stormwater Channel. Due to the limitation of the District's financial resources, the levees presently along the stormwater channel through much of the study area were not built at that time, and although no information is available as to the exact date of their construction, it was sometime before the 1940s, because these levees are mapped on the 1941 USGS map.

Historic Resources

Historic resources are usually defined as sites that contain one or more standing structures associated with the historic period, that is, the period associated with post-European contact and with written records. Historical resources can also be structures that are not functional, or a site with no structures which is associated with a significant event that occurred there in the past.

An inventory of historic resources was prepared for Riverside County in 1993 (*Guide to the Historic Landmarks of Riverside County California*, Riverside County Historical Commission Press). This guide includes a number of categories for historical designation as follows:

- **National Register of Historic Places** - This designation is administered by the National Park Service and is the official list of the Nation's cultural resources worthy of preservation. These resources may include historic and prehistoric sites, structures, and objects that are significant to American history, architecture, archaeology engineering and culture.
- **California Registered Historical Landmarks** - This program is administered by the California Office of Historic Preservation and recognizes properties of statewide historical significance to California. Areas of consideration include but are not limited to, anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, and experimental sites of significance. The site is generally the first, last, only or most significant of a type in a region of the state.
- **California Points of Historical Interest** - This program is administered by the California Office of Historic Preservation. It enables the state to recognize sites of local importance and to officially register them as California Points of Historical Interest.
- **Riverside County Historical Landmarks** - Sites and structures with a high degree of historical and/or architectural integrity, and which are worthy of being preserved, would be declared to be County Historic Landmarks or Historic Preservation Districts, by the County Board of Supervisors upon recommendation by the Historical Commission. Sites meeting the eligible criteria are then submitted to the State for Points of Historical Interest designation.

The only designated historic site within the Study Area is the Coachella Valley Water District Building located at Highway 111 and Avenue 52 in the City of Coachella. This site is designated as a California Point of Historical Interest and as a Riverside County Historical Landmark. The District was established in 1918 to protect and conserve the watershed, underground water storage, and to seek additional sources of irrigation. The first Colorado River water was delivered to the Coachella Valley upon completion of the Coachella Branch of the All-American Canal on March 29, 1949.

Designated historic sites within the project vicinity include the Coachella Valley Fish Traps located about two miles south of the Study area at the end of Jackson Street, and the Valerie Jean Date Garden located on Harrison Street at Avenue 66 about two miles south of the Study Area. The "Fish Traps" are on the National Register of Historic Places, and are thought to have been used by Indians 400 to 700 years ago to trap fish in the Ancient Lake Cahuilla which once covered a large part of the Coachella Valley. The "Valerie Jean" site is designated as a California Point of Historical Interest and as a Riverside County Historical Landmark. It was established in 1928 and was the first mail-order date and date products business which achieved world-wide success.

In addition to the above information, a historical records search was also conducted at the Eastern Information Center. The records search indicated that there is no property within the study area that is listed in the National Register of Historic Places. Other listed historical sites within the project vicinity that are not discussed above are the Martinez Historic District, a National Register listing about two miles south of the Study Area and a California Point of Historical Interest located just outside the Study Area which is the site of an ancient Indian village known variously as Torres, Torros, or Toro.

Within the study area boundaries, the California Historical Resources Inventory indicates the presence of 43 buildings or other features that are of various levels of historical significance. The vast majority of these properties are clustered within the historic townsites of Coachella and Thermal. The names, addresses, and National Register eligibility codes, an indication of their historical significance, are listed below in Table 3.9-1. As indicated on this table, most of these properties are not eligible for the National Register listing but are of local interest only. Of the 43 listings in the Inventory, there are 12 listings which are categorized as either Eligibility Code 3, "appears to be eligible" or Eligibility Code 4, "may become eligible" for National Register listing. Figure 3.9-1 illustrates previously identified historical resources in the Planning Area.

Table 3.9-1, Historic Buildings and Features Listed in the California Historical Resources Inventory
(Source: Eastern Information Center, University of California, Riverside)

Prop. No.	Common Name	Address	N. R. Eligibility *
33-5637	"Bud" Martin House	87-210 Center Street, Thermal	5
33-5638	Thermal Hotel	87-213 Center Street, Thermal	5
33-5639	John Kelly House	87-232 Center Street, Thermal	5
33-5640	None	87-352 Center Street, Thermal	4
33-5641	Dick Wood Home	87-191 Kokell Avenue, Thermal	7
33-5642	None	87-311 Kokell Avenue, Thermal	7
33-5643	Alderman House	56-324 Market Street, Thermal	5
33-5644	Wool Ranch	84-281 Avenue 58, Thermal	5
33-5645	McPheeters Ranch	84-801 Avenue 58, Thermal	3
33-5646	Triple AAA Water Company	56-273 Highway 111, Thermal	5
33-5647	DeVore Ranch	84-800 Bagdad Avenue, Coachella	4
33-5649	Covalda Date Company	51-392 Harrison Street, Coachella	3
33-5650	Women's Club of Coachella Valley	51-893 Harrison Street, Coachella	3
33-5651	None	1105 Vine Avenue, Coachella	5
33-5652	Our Lady of Solidad Catholic Church	1612 First Street, Coachella	3
33-5653	None	1451 Third Street, Coachella	5
33-5654	None	1445 Fourth Street, Coachella	5

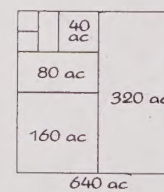
Prop. No.	Common Name	Address	N. R. Eligibility *
33-5655	Syrus Hughs House	1457 Fourth Street, Coachella	5
33-5656	None	1322 Sixth Street, Coachella	5
33-5657	None	1336 Sixth Street, Coachella	5
33-5658	Reed Building	1601 Sixth Street, Coachella	5
33-5659	Lopes Hardware Store	1604 Sixth Street, Coachella	3
33-5660	Rolavision Store	1694 Sixth Street, Coachella	5
33-5661	None	1309 Seventh Street, Coachella	5
33-5662	Palm View School	1390 Seventh Street, Coachella	5
33-5663	Submarine	1463 Seventh Street, Coachella	3
33-5664	Ceramics	1604 Seventh Street, Coachella	5
33-5665	None	1609 Seventh Street, Coachella	5
33-5666	Power Office	1684 Ninth Street, Coachella	3
33-5667	Payne Dairy	55-526 Highway 86, Coachella	5
33-5668	Hamner Home	85735 Highway 111, Coachella	5
33-5669	City Hall	1515 Sixth Street, Coachella	6
33-5670	Old Fire House	1515 Sixth Street, Coachella	5
33-5681	King Ranch	88-675 Avenue 58, Thermal	5
33-5682	Clark Ranch	88-456 Avenue 57, Thermal	3
33-5683	None	85-495 Avenue 61, Thermal	5
33-5685	Hagerty Ranch	58-491 Jackson Street, Thermal	5
33-5694	Roy Harmon House	56-210 Palm Street, Thermal	5
33-5695	Hollis Ranch	570605 Van Buren Street, Thermal	5
33-5705	Coachella Canal	None	6
33-5711	Laflin Date Garden	88-217 Avenue 59, Thermal	3
33-5792	Friends of Jesus Church	85-490 Avenue 50, Coachella	3
33-6043	Thermal Army Airport A(Z-1) Bombardment Squadron Storage Structure	None	7

* National Register eligibility codes: 1-Listed in the National Register; 2-Determined eligible for listing; 3-Appears to be eligible; 4-May become eligible; 5-Not eligible for the National Register but of local interest; 6-None of the above; 7-Not evaluated



Previously Identified Historical Resources

-  California Historical Inventory Primary Numbers (add "33-" prefix to the 4 digits shown here: e.g. "33-5705")
-  California Point of Historical Interest



Source:
Eastern Information Center,
Univ. of California, Riverside

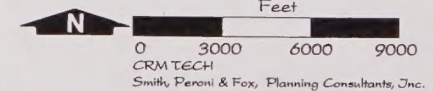
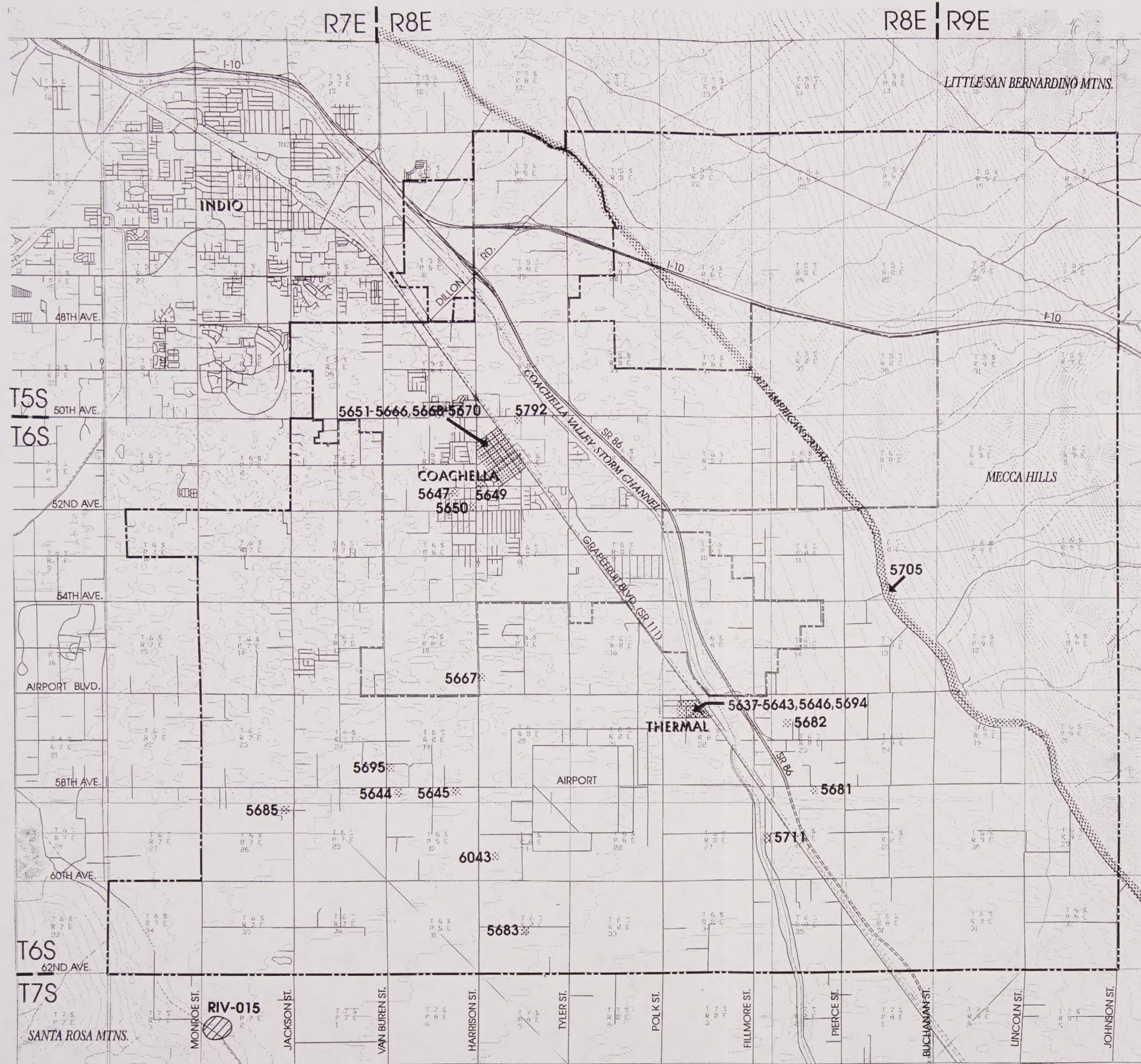


Figure No. 3.9-1





Archaeologic Resources

There are Generally two categories of archaeological resources: (1) Prehistoric archaeological resources, which for purposes of this document, are defined as sites that are associated with native Indian populations prior to contact with Europeans, and (2) historical archaeological resources which are defined as sites associated with post-European contact and with written records. Historical archaeological sites must be studied using archaeologic (i.e., excavation) methods since the features are partially or totally underground. This difference in study methodology distinguishes historic archaeologic sites from "historical resources" which is discussed above.

A number of archaeological surveys have been conducted within the Planning Area and are presented in Figure 3.9-2 (Cultural Resource Survey as of March 1996). They are categorized by MF (manuscript file) numbers and can be used as a reference when requesting information from the Eastern Information Center. Approximately 18% of the Planning Area has been surveyed by professional archaeologists. These surveys have identified more than fifty archaeological sites within the study area. The majority of sites contain scatters of pottery fragments, chipped stone, fire-affected rock, and burned animal bone, which is typical debris from Indian occupation. Some sites revealed remains of Indian cremations which are considered very sensitive by living Indians today. Sites range in size and significance from a small scatter of pottery sherds to remains of major villages. In the Mecca Hills, several Indian trails have been recorded, testament to the Native tradition of long-distance travel and communications with neighboring bands. Non-Indian sites are also recorded as scatters of old building materials and features with varying degrees of significance. Table 3.9-2, summarizes the findings.

The precise locations of these archaeological sites are confidential and may not be released to the public. A map showing their distribution has been compiled and is on file at the City of Coachella and can be reviewed by professional archaeologists and historians. Property owners in the project area may inquire at the City about any archaeological sites within their property and will be informed of any sites when seeking development approvals.

Paleontologic Resources

Paleontologic resources are the fossil remains or traces of past life forms, including both vertebrate and invertebrate species, as well as plants. A paleontologic resources records search was conducted through the Regional Paleontological Locality Inventory by Robert Reynolds, the Curator of the Earth Sciences Division of the San Bernardino County Museum. The study area is located on the following rock types described by potential from the oldest type:

- **Granitic Rocks - Low Potential:** Granitic rocks are approximately 100 million years in age and have a low potential for containing significant non-renewable paleontological resources.
- **Palm Springs Formation - High Potential:** Sandstones and siltstones of the Palm Springs Formation have a high potential for containing significant non-renewable paleontological resources.
- **Lake Cahuilla Sediments - High and Undetermined Potential:** Silts and sands of Pleistocene and early Holocene Lake Cahuilla contain fossil birds, pond turtles, large and small fish, and bivalves and snails. High potential is assigned to the area expressed at or below the high stand of the Lake Cahuilla shoreline. Undetermined potential is assigned to areas which are underlain by Lake Cahuilla sediments, but which are overlain by recent sediments from the Whitewater Delta and have been disturbed by agriculture.

Table 3.9-2, Archaeological Sites Recorded in the Study Area
(Source: Eastern Information Center, University of California, Riverside)

Site No.	Description
CA-RIV-135	Small site recorded in 1951 but nothing observed in 1990.
CA-RIV-148	Major Indian village site, occupied through the end of the 19th century.
CA-RIV-149	A large Indian village site, now mostly destroyed and built over.
CA-RIV-159	Site recorded in 1960 as light scatter of flakes and sherds, not visible in 1987.
CA-RIV-795	Small scatter of 10-15 pottery sherds.
CA-RIV-1116	Large pottery scatter and trail segment.
CA-RIV-1339	Possible Indian house remains with cremation site.
CA-RIV-1340	Medium size site of flakes, pottery sherds, groundstone fragment.
CA-RIV-1343	Thin and widespread scatter of pottery sherds.
CA-RIV-1539	Medium size site of flakes, pottery sherds, charcoal, burned animal bone.
CA-RIV-1540	Small scatter of 5-10 sherds.
CA-RIV-1756	On Augustine Reservation, medium size site of flakes and sherds.
CA-RIV-1757	On Augustine Reservation, medium size site of flakes and sherds.
CA-RIV-1758	On Augustine Reservation, small scatter of pottery sherds.
CA-RIV-1759	On Augustine Reservation, medium size site of flakes and sherds.
CA-RIV-1760	On Augustine Reservation, small scatter of pottery sherds.
CA-RIV-1761	Human cremation site, pottery, beads, arrow points, flakes.
CA-RIV-1762	On Augustine Reservation, medium size site of flakes and sherds.
CA-RIV-1763H	Augustine Indian Reservation Cemetery
CA-RIV-1764H	Historic Augustine structures, adobe house remains, pumphouse, etc.
CA-RIV-2982	Important Indian village site with cremations, flakes, pottery, ashy areas, etc.
CA-RIV-2983	Medium size site of flakes, pottery sherds, groundstone fragments.
CA-RIV-2984	Reported as Indian cremation sites in 1984, Small scatter of flakes in 1990.
CA-RIV-2985	Medium size, low density scatter of pottery sherds and flakes.
CA-RIV-2986	Reported as small sherd and flake scatter in 1984, nothing observed in 1990.
CA-RIV-2987	Medium size, low density scatter of pottery sherds and flakes.
CA-RIV-4113	Medium size site of flakes, pottery sherds, groundstone fragments, point.

Site No.	Description
CA-RIV-4126	Medium size, low density scatter of pottery sherds and flakes.
CA-RIV-4127	Indian cremation site with sherds and flakes.
CA-RIV-4128	Large site with Indian cremation, concentrations of sherds and flakes.
CA-RIV-4129	Medium size, low density scatter of pottery sherds and flakes.
CA-RIV-4130	Medium size, low density scatter of pottery sherds, flakes, groundstone.
CA-RIV-4131	Medium size, low density scatter of pottery sherds and flakes.
CA-RIV-4174	Medium size, low density scatter of pottery sherds and flakes.
CA-RIV-4844	Indian trail segment.
CA-RIV-4852	Indian stone chipping area associated with an Indian trail and rock cairns.
CA-RIV-4894	Indian trail segment.
CA-RIV-4916	Indian trail segment.
CA-RIV-4919	Indian trail segment.
CA-RIV-5158	Small scatter of 10-15 pottery sherds.
CA-RIV-5211	Small site of pottery sherds, groundstone fragment.
CA-RIV-5325H	1930s-1950s trash dumps.
CA-RIV-5398	Medium size, low density scatter of pottery sherds, flakes, groundstone.
CA-RIV-5509H	Scatter of historic period artifacts, earthenware, porcelain, glass, etc.
CA-RIV-5511H	Farmstead site with reservoir, concrete features, fence lines, etc.
CA-RIV-5584	Small scatter of 10-15 flakes.
CA-RIV-5585	Small scatter of 15-20 flakes.
CA-RIV-5586	Small scatter of 5-10 flakes.
CA-RIV-5587	Small scatter of 5-10 flakes.
CA-RIV-5588	Large scatter of 100s of quartz flakes and important geoglyph.
CA-RIV-5589	Small scatter of 15-20 flakes.

- Recent Alluvium - Low Potential:** Recent alluvium has low potential to contain significant non-renewable paleontological resources. The recent alluvium and dune sand does not contain fossils in a meaningful context.

Most of the urbanized portion of the study area (i.e., the western half) is of Undetermined Potential, while the area generally between the Whitewater River and the All-American Canal is of High Potential (see Figure 4.9-4). The alluvial fans and canyons at the base of the Mecca Hills are of Low Potential while the Mecca Hills themselves have a High Potential for paleontologic resources.

Thresholds of Significance

According to CEQA, cultural resources are defined as archaeological sites, historic buildings, structures or objects, and properties of unique ethnic cultural value or religious/sacred use. Significant impacts to cultural resources would include actions which would destroy or degrade "unique" or "important" cultural resources as defined by Appendix K of CEQA.

Project Impacts and Mitigation Provided by General Plan Policy

Historic Resources

Implementation of the General Plan will encourage development within the Planning Area throughout the life of the Plan which could potentially result in partial or complete destruction of historic resources which would be an adverse impact. However, policies in the General Plan, discussed below, are designed to identify, maintain, and protect historic resources within the Planning Area.

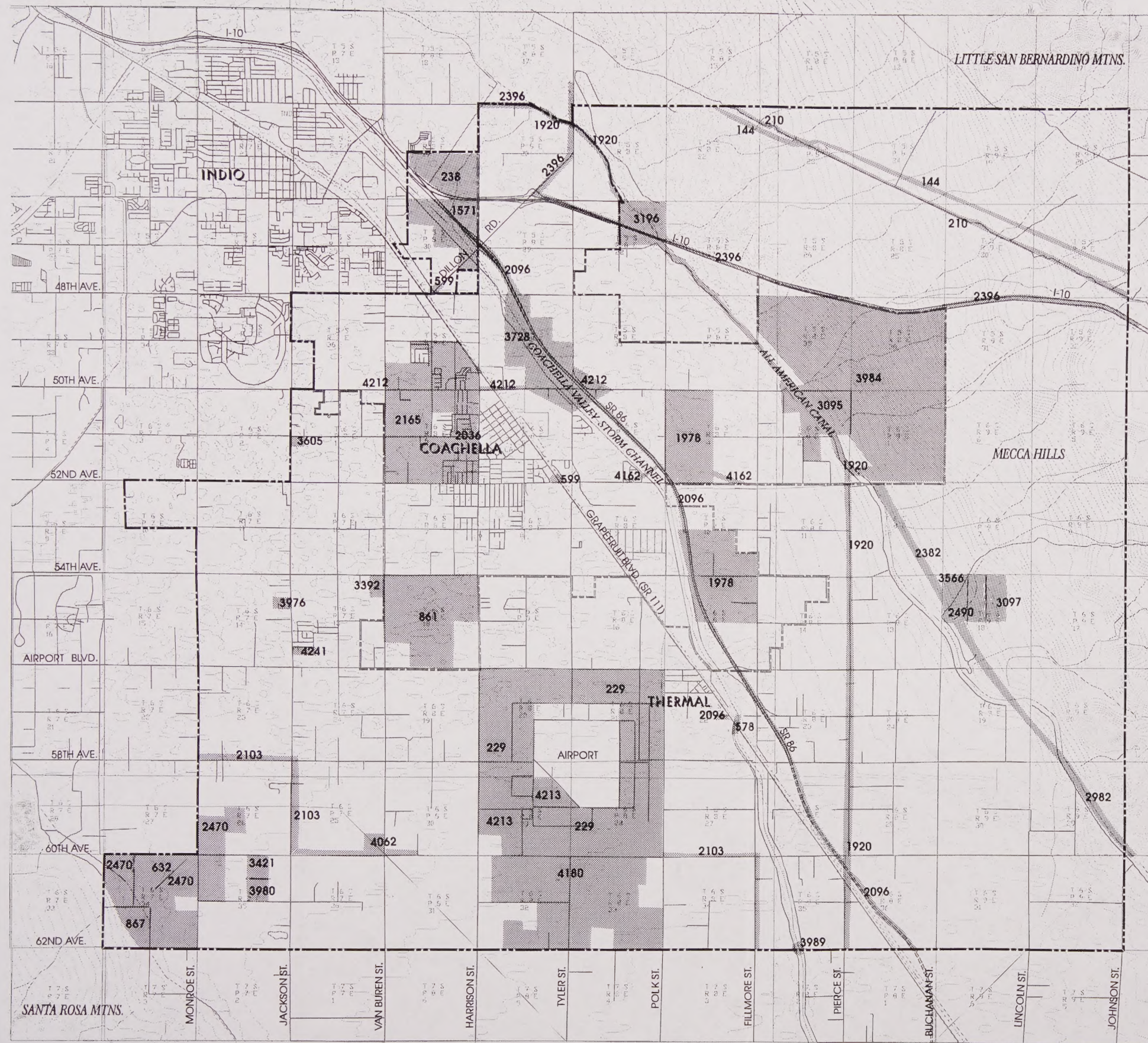
Figure 3.9-3 illustrates the potential for historic (non-Indian) resources in the Planning Area. With regard to historic cultural resources, the townsites of Coachella and Thermal in Sections 5 and 22, T6S R8E, demonstrate a high degree of sensitivity. Aside from these two relatively small pockets, which encompass less than one square mile in total area, the level western portion of the study area lying southwest of the Coachella Canal has a medium potential for historic resources, while the hilly eastern portion of the study area northeast of the Canal is generally low in sensitivity in this aspect. A stated goal of the General Plan is to integrate historic resources into the framework of the City. General Plan policy requires appropriate mitigation measures to evaluate, document and/or protect historic resources where necessary. General Plan policy encourages incorporating historic resources into open space areas where possible. Finally, General Plan policy requires the City to recognize historic landmarks according to the National Register of Historic Places eligibility codes for those sites identified in Table 3.9-1. It also provides that the City will facilitate preservation of such landmarks through the use of historic preservation ordinances and other mechanisms.

Therefore, because the General Plan contains policies which ensure that historical resources will be identified, evaluated and preserved as necessary, no significant impacts will occur as a result of General Plan implementation.

Archaeological Resources

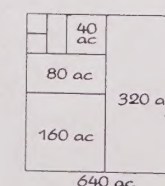
Implementation of the General Plan will encourage development within the Planning Area. This could result in an adverse impact on archaeologic resources since development is proposed in areas that have not been surveyed. However, Policies in the General Plan, discussed below, are designed to identify, evaluate, and mitigate potential impacts on archaeologic resources within the Planning Area.

Virtually any piece of land within the study area has some potential for archaeological resources, be they Indian or non-Indian. A comparison of the map of previous surveys with the map showing recorded sites reveals an almost 1 to 1 relationship. In other words, wherever archaeological surveys have been performed, archaeological sites have been found. Even the Mecca Hills, which appear waterless, barren, and inhospitable to Indian occupation, show remains of Indian trails that have cultural and historical



Cultural Resource Survey as of March 1996

Areas previously surveyed for archaeological resources, identified by manuscript file (MF) numbers. Reports & site records are on file at the Eastern Information Center, UCR.



Source:
Eastern Information Center
Univ. of California, Riverside

CRMTECH
Smith, Perini & Fox, Planning Consultants, Inc.

Figure No. 3.9-2

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value. Indian villages have been discovered in what appear to be barren areas today, because historically, the groundwater table was close enough to the surface for the Indians to dig walk-in wells. As a typical example, archaeological surveys discovered numerous remains (i.e., pottery sherds, beads, arrow points, adobe dwelling remains) and recorded a large archaeological site covering many acres west of the Thermal Airport. In addition, several surveys recorded remains of Indian cremation sites which require special handling. A General Plan policy deals with this issue and requires consultation with Native American groups including the Native American Heritage Commission to determine significance of the finding. A mitigation plan can then be developed which would either preserve the site or the remains could be removed and reinterred.

A stated goal of the General Plan is to recognize and integrate significant archaeologic resources into the framework of the City and General Plan policy is to identify and preserve archaeologic resources for their scientific, educational, aesthetic, and cultural values. A map showing the distribution of known archaeological resources (as of March 1996) has been compiled and is available at the City of Coachella for review by professional archaeologists and historians. General Plan policy requires that all property development covered under CEQA must be reviewed by the Eastern Information Center through a "quick check" or transmittal level records search. The transmittal identifies the presence or absence of existing resources and/or previously performed studies in or near the project area. Although a records search for the project area has been conducted to date, the data base is constantly updated to reflect new field surveys. The EIC will also recommend further studies, (i.e., a field survey by a qualified archaeologist) if warranted.

Cultural resources that are identified during a records search or field survey need to be evaluated for significance according to Appendix K of the CEQA Guidelines which establishes criteria for the significance assessment of archaeological resources. Only those resources found to be significant need to be mitigated. General Plan policy requires that if a finding of significance is made, an appropriate mitigation plan shall be implemented. The mitigation plan can take many forms with the most preferable being preservation of the site intact. Other mitigation methods are also available, however. Consequently, the presence of an archaeological site within a piece of property does not preclude development, but requires an appropriate mitigation plan. Therefore, because policies in the General Plan will ensure that cultural resources will be identified, evaluated and mitigated as necessary, no significant impacts will occur as a result of General Plan implementation.

Paleontologic Resources

Implementation of the General Plan will encourage development within the Planning Area. This could result in an adverse impact on paleontologic resources if steps are not taken to prevent their destruction. However, Policies in the General Plan, discussed below, are designed to identify, evaluate, and mitigate potential impacts on paleontologic resources within the Planning Area.

For areas of low potential, a project specific paleontological resource impact mitigation program need not be prepared. However, if paleontological resources are encountered during excavation, a qualified expert must be contacted (i.e., San Bernardino County Museum) and a mitigation plan implemented. Figure 3.9-4, Paleontologic Resource Sensitivity Map, illustrates the potential for paleontologic resources in the study area.

Prior to development in areas of high or undetermined potential, a number of procedures must be followed as defined by the San Bernardino County Museum. These procedures include salvaging fossils from known localities, monitoring of excavation in areas likely to contain resources, preparation of recovered specimens to a point of identification, and preparation of a report of findings with an itemized inventory of specimens.

Therefore, because the General Plan contains policies which ensure that paleontological resources will be identified, evaluated and mitigated as necessary, no significant impacts will occur as a result of General Plan implementation.

Additional Mitigation and Unmitigable Impacts

Historic Resources

There are not anticipated to be any unmitigable significant adverse impacts upon historical resources as a result of General Plan implementation. The General Plan Policies cited above will provide adequate mitigation and no further measures are necessary.

Archaeologic Resources

There are not anticipated to be any unmitigable significant adverse impacts upon archaeological resources as a result of General Plan implementation. The General Plan Policies cited above will provide adequate mitigation and no further measures are necessary.

Paleontologic Resources

There are not anticipated to be any unmitigable significant adverse impacts upon paleontological resources as a result of General Plan implementation. The General Plan Policies cited above will provide adequate mitigation and no further measures are necessary.



Paleontological Resource Sensitivity

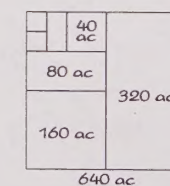
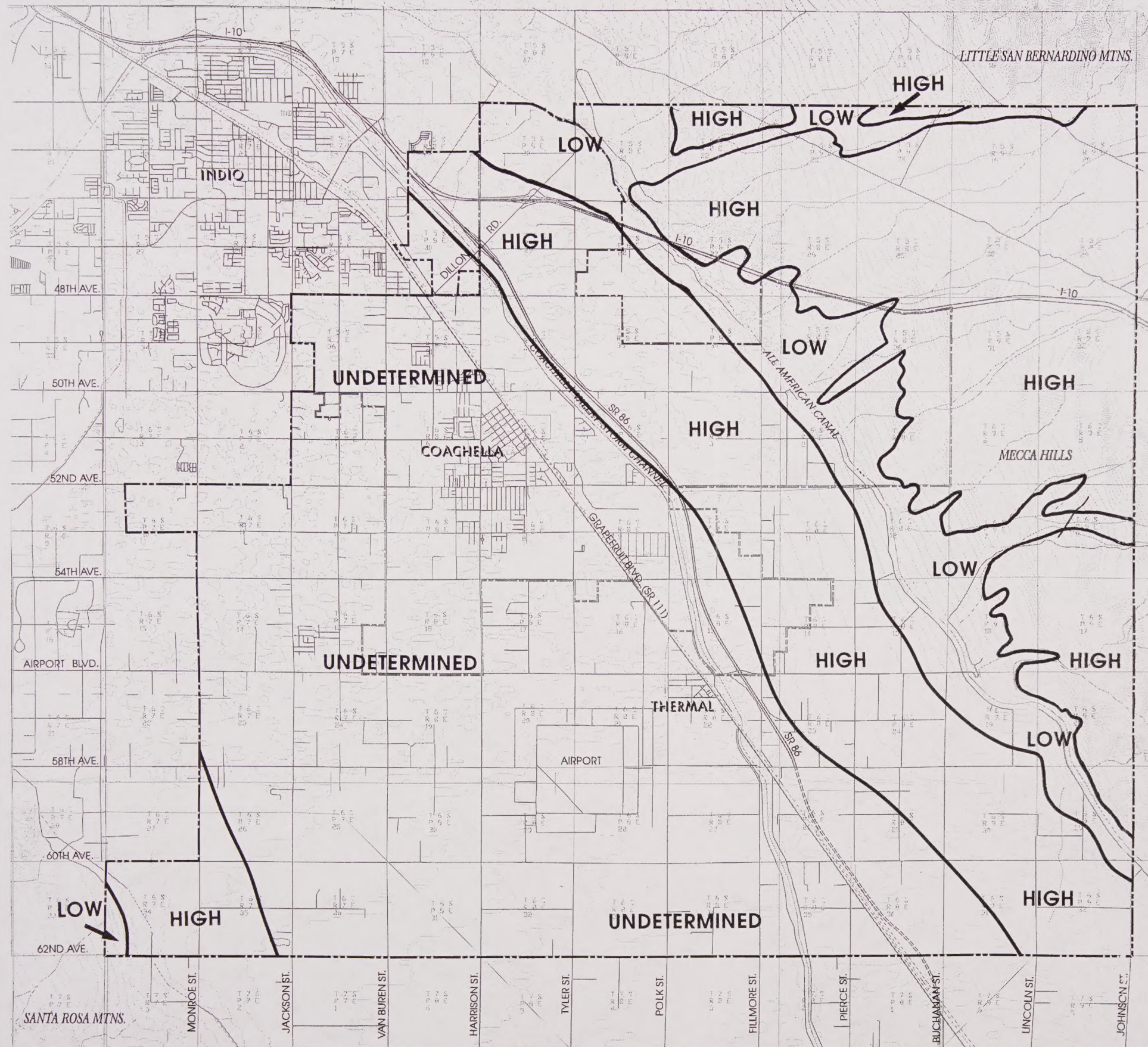
NOTE:

"Low", "High" & "Undetermined" designations indicate potential for occurrence of paleontological resources based on sediment type.

Areas of Low Sensitivity consist of Granitic Rock & Recent Alluvium.

Areas of High Sensitivity consist of Palm Springs Formation & Lake Cahuilla Sediments.

Areas of Undetermined Sensitivity consist of Lake Cahuilla Sediments which have been disturbed by agriculture or overlain by recent sediments.



Source:
San Bernardino County Museum

Figure No. 3.9-4



3.10 Public Utilities

3.10.1 Water

The following section is based on the February 1991 Water Master Plan prepared for the City of Coachella by NBS/Lowry Engineers, the 1991-92 CVWD Engineer's Assessment on Water Supply and Replenishment, and the 1993-94 and 1994-95 CVWD Annual Reviews as well as discussions with NBS Lowry, the City Engineer and officials of the Coachella Valley Water District in early 1996.

Existing Conditions

Groundwater Conditions

Groundwater has historically been the principal source of water supply in the Coachella Valley. Nearly all urban and suburban water needs in the Coachella Valley are met by groundwater extraction. The project area is located at the southeasterly end of the Coachella Valley Groundwater Basin as defined by the Department of Water Resources (DWR)¹. This groundwater basin encompasses most of the Coachella Valley from the San Geronio Pass to the Salton Sea and has been subdivided by the DWR and US Geological Survey into four interrelated water bearing sub-basins which are delineated by fault barriers that restrict the lateral movement of groundwater. Specifically, the project area lies within the Whitewater River (or Indio) sub-basin which encompasses approximately 400 square miles and extends from approximately one mile west of the intersection of State Highway 111 and the Interstate 10 Freeway to the Salton Sea. Coachella is further located within the Thermal Subarea of the Whitewater Sub-basin. It is also noteworthy that the lower valley basins, including the Coachella area, are overlain by a layer of clay which blocks the flow of surface water to and from the aquifer.

Since the early 1970's, the Coachella Valley Water District has managed overdraft conditions in the upper valley water basin via a well monitoring and replenishment fee program. Overdraft describes a condition where more water is being removed from the aquifer than is being returned to it resulting in a gradual decrease in the overall amount of groundwater stored and a lowering of the groundwater table. Using imported water from the Colorado River, CVWD operates a recharge area north of Palm Springs in conjunction with this program. Recently, CVWD indicates that the groundwater basin in the lower valley as well is showing signs of overdraft including a drop in the water table.

Groundwater Recharge

Groundwater recharge is the term applied to the replacement of water into the groundwater aquifer by both natural and artificial means. Within the Coachella Valley, groundwater replenishment through direct precipitation is negligible due to the small amount of annual precipitation which falls on the valley floor. Direct precipitation averages about 5 inches per year in contrast with an average evaporation rate of approximately 75 inches per year in the same area.

Percolation of water from stream flows, which originate in the adjacent mountain areas, serves as the largest natural source of groundwater replenishment in the Lower Coachella Valley. These stream flows develop from rain and snowmelt and are transported to the Lower Coachella Valley, including the project area, primarily by the Whitewater River and surrounding canyons. In addition to these naturally occurring drainages, percolation from the Coachella Canal serves as another source of groundwater replenishment.

¹ Coachella Valley Water District, Engineer's Report on Water Supply and Replenishment Assessment 1991/1992, p. 3,4

Supplementing these natural processes, artificial recharge serves as a further source of groundwater replenishment. In the early 1970's, the Coachella Valley Water District began managing overdraft in the upper valley water basin via a well monitoring and replenishment fee program. The replenishment program, which remains in effect, consists of obtaining supplemental water from the Colorado River aqueduct of the Metropolitan Water District (MWD) for use in recharging the groundwater basin in exchange for Desert Water Agency (DWA) and CVWD entitlements of State Project water. This supplemental water is obtained through a turnout from the MWD aqueduct at Whitewater and follows the natural channel of the Whitewater River to spreading facilities located near Windy Point north of Palm Springs. Currently, this program results in direct recharge only to the upper basin while the lower basin benefits indirectly through underground seepage from the upper basin.²

In spite of these measures, the lower basin has been experiencing signs of overdraft including a drop in the water table due to increased pumping for urban and agricultural uses. CVWD is investigating measures to address this situation including the institution of a replenishment fee program similar to the one used in the upper valley along with the construction of associated recharge basins in the lower valley. Siting recharge basins in the lower valley is a more critical task than in the upper valley, due to the restrictive clay layer which inhibits percolation to the deep aquifers over much of the lower basin. In 1993, CVWD developed its first lower basin recharge facility at the southwest corner of the Coachella General Plan project area (the corner of Madison Street and Avenue 62)³. This project is a pilot facility and consists of a one acre retention area which will be expanded to occupy between 20 to 40 acres if the site shows favorable percolation rates. CVWD is actively investigating other potential recharge sites as well.

The water agencies are also actively seeking additional supplies of imported water to increase the amount of water available for recharge purposes. For example, in early 1996, CVWD and DWA entered into an agreement with the State Water Project to purchase an additional 104,000 acre feet of water for groundwater recharge, more than doubling the current 61,000 acre-feet of water purchased from the State.⁴

Water Service Providers

Two primary water service providers operate facilities within the Coachella General Plan Project area. The Coachella Municipal Water Department serves the incorporated area with potable water and covers an effective service area of approximately 21 square miles or 25% of the Project Area. Unincorporated areas are served by the Coachella Valley Water District (CVWD) with an effective service area of approximately 63 square miles or 75% of the Project Area.

City of Coachella Potable Water Supply and Distribution System

As discussed above, the City relies on groundwater extraction from the Whitewater River sub-basin as its chief source of potable water. Using water from this source, the City operates a water supply, storage, and delivery system consisting of wells, reservoirs, booster stations, and distribution lines. These are described more fully as follows.

Currently, the City has two reservoirs; a 1.5 million gallon (MG) water tank located in the northeast corner of Section 28 just south of 46th Avenue and west of Polk Street. The tank is 90.5 feet in diameter and stands 32 feet high with a ground elevation of 115.5 feet above mean sea level with a hydraulic grade

² *Ibid.*, p. 21

³ Coachella Valley Water District, *Annual Report 1993-94*, p. 8

⁴ Deborah Sullivan, "Agencies buy water to help boost resources," *Desert Sun*, April 5, 1996

line (HGL) of 615 feet (it is standard practice to add 500 feet to the actual ground elevation since most of the area is below mean sea level). The second storage tank is 3.6 MG is located near 51st Avenue due east of the center of Section 6, west of Highway 86. The tank is 154 feet in diameter and stands 24 feet high with a hydraulic grade line of 454 feet. This tank uses a booster to pump water into the system because its HGL is only 454 feet (when full). Future tanks should be built at ground elevations of 615 feet to make use of gravity flow.⁵

The City's water system employs the use of four active wells with a total production capacity of approximately 3750 gallons per minute (GPM - 2.6 MGD). Well No. 12 pumps directly into the 3.6 MG tank which in turn pumps into the system. Well Nos. 10 and 11 boost water to the 1.5 MG tank during times of lower demand and into the system during times of higher demand. An additional well (Well No. 7) pumps water into the system and a new well north of Avenue 54 and east of Tyler Street provides 2,600 GPM. In 1991, when the Water Master Plan was completed, the water distribution system was running at its maximum capacity during days of peak demand.⁶

The City's existing water system is organized around two pressure zones. The upper zone lies north of 48th Avenue and has very few service connections. The lower zone lies south of 48th Avenue, bounded by Van Buren on the west, the Coachella Valley Storm Drain on the east and 54th Avenue on the south and serves the remainder of the City. The current two zone system was implemented to alleviate the problem of broken lines occurring at some of the older homes in the southern area due to high pressure. While the pressure reducing valves (PRV's) minimize broken pipes in older homes, it also lowers the water pressure in the rest of the City's systems which can cause problems during a fire.⁷ Some of the existing transmission lines are inadequate to meet the demands of the future and will need to be paralleled or replaced.

The City has prepared a Water Master Plan to address long term water storage and distribution needs. The Master Plan calls for the construction of new wells, reservoirs, and water distribution lines within the incorporated City and its immediate environs. The Master Plan also makes recommendations as to sources of funding for these infrastructure improvements but the City has yet to develop a formal implementation program.

The Water Master Plan provides a detailed description of water improvements needed to accommodate future growth within the existing incorporated City and its immediate environs and is summarized here. The City will need to construct new wells in order to supply water for future growth. The exact location of the wells would be determined by a geohydrologist who is experienced in groundwater development. Additional reservoirs would be needed with a total storage capacity for average day demand plus fire flow requirements estimated at 65 million gallons. The future reservoirs will be located at the HGL of the Ultimate Water Distribution System primarily in the Mecca Hills. Pump stations will be required to pump water into new pressure zones 3, 4, 5 and 6 and should be located below the zone being served and must provide peak day demand with fire flow coming out of the reservoir.⁸

CVWD Potable Water Supply and Distribution System

CVWD's primary source of potable water is groundwater from the Whitewater River sub-basin. CVWD utilizes wells to extract groundwater for delivery of potable water to portions of the unincorporated Study Area. Currently, CVWD provides water service within the project area to only a limited number of sites

⁵ NBS Lowry, *Water Master Plan for the City of Coachella*, February 1991, p. III-2

⁶ *Ibid.*, p.III-2

⁷ *Ibid.*, p.III-1

⁸ *Ibid.*, p.IV-1-4

including the community of Thermal and a few scattered subdivisions along Jackson Street. Typical CVWD wells range in depth between 400 to 1000 feet with a capacity of 1,600 to 2,000 gallons per minute (GPM). The Thermal area is served by existing wells with a capacity of 250 to 750 GPM and a 200,000 gallon storage tank.⁹

CVWD's water service is defined by three basic zones within the unincorporated area. These include 1) the Cahuilla Zone which covers that portion of the unincorporated study area generally west of Van Buren Street and is served by local wells but will receive water by 1998 from CVWD's planned 10 million gallon Cahuilla reservoir, 2) the Thermal Zone which is served by facilities located near the intersection of Airport Boulevard and Van Buren Street and serves the western portion of the valley from Van Buren Street west to the All American Canal, and 3) the unincorporated portions of the Mecca Hills area east of the All American Canal which are presently unserved by any water supply, storage, or distribution facilities.¹⁰ Only limited distribution lines currently exist in these zones but CVWD is prepared to expand service as development occurs.

CVWD is planning development of a new 500,000 gallon reservoir, 2,000 GPM well and 2,800 GPM booster station at the intersection of Van Buren and Airport Boulevard to better serve the Thermal Zone.¹¹ The new well has been drilled and will be functional in June of 1996 while the other facilities are expected to be constructed within the next 2-5 years (1998-2001). The District's planned 10 million gallon reservoir near Lake Cahuilla is in the final stages of property acquisition and is scheduled to begin construction in late 1997 with completion estimated by mid 1998.¹² Existing water distribution lines entering the study area at Airport Boulevard will convey water from the reservoir to serve the Cahuilla Zone. The existing wells will also be integrated into the system and contribute water to fill and maintain water levels at the reservoir.

CVWD maintains only a limited number of water distribution lines within the project area. These lines occur within portions of Airport Boulevard and Jackson Street and within the unincorporated community of Thermal. Water lines within the CVWD service area range in size between 6 to 18 inches in diameter and are constructed of AC, steel and ductile iron. These distribution lines have not exhibited any unusual levels of water leakage indicating deterioration or aging problems.

CVWD Agricultural Water Supply and Distribution System

In addition to the delivery of potable water, CVWD also is the primary deliverer of irrigation water for agricultural use in the Coachella Valley which are largely centered around the cities of Indio and Coachella. The majority of water for irrigating agricultural lands in the Study Area is imported from the Colorado River via the All-American Canal which was constructed by the Federal Bureau of Reclamation in the 1940s and currently operated by the CVWD. This water is distributed to individual farmers through an extensive system of irrigation pipelines constructed of precast concrete with a corresponding system of agricultural tile drains that return excess irrigation water and perched groundwater to the Coachella Valley Storm Channel. Agricultural tile drains are discussed in detail in Chapter 3.3, Surface Drainage. The remainder of irrigation water used in the study area is derived from private wells. According to the CVWD, total water sold for irrigation purposes was approximately 289,000 acre-feet for fiscal year 1993-94.¹³

⁹ Personal communication, Martin Magana (SPF) with CVWD staff, 1995

¹⁰ Personal communication, Dan Ruiz (CVWD) with Paul DePalatis (SPF), April 1996

¹¹ Personal communication, John Corella (CVWD) with Paul DePalatis (SPF), April 1996

¹² Dan Ruiz (CVWD)

¹³ CVWD Annual Report, 1993-1994

Water Demand

The Water Master Plan contains a number of factors for domestic water demands based on the type of land use and the usage per acre. Utilizing these factors and the existing land use acreage described in Section 3.1, current domestic consumption rates were calculated and are summarized in Table 3.10-1, Existing Domestic Water Demands, shown below. Current domestic water usage for the study area is estimated to be approximately 140,000,000 gallons per day of which 96% is due to agricultural usage.

Table 3.10-1 Existing 1996 Water Demand			
Land Use	Acreage Change	Demand Factor (GPD/AC) ^{1,2}	Total Usage (GPD)
Residential	1,380.8	2,073	2,862,398
Commercial	223.4	3,500	781,900
Industrial	478.9	3,500	1,676,150
Agriculture	21,837.7	6,160	134,518,048
Total			139,838,497

¹ Residential, Commercial and Industrial water demand factors are based on Table IV-2, Domestic Water Demands from the 1991 City of Coachella Water Master Plan. Residential factor has been weighted to reflect land use mix of 78% single family and 22% multi-family units.

² Agricultural water demand factor is based on discussions with Coachella Valley Water District using an annual demand factor of 6.9 acre-feet per acre of agricultural land.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate water supply and distribution facilities could not be provided to serve projected development. In addition, substantial increases in water consumption which would accelerate overdraft of underground aquifers is considered a significant impact.

Project Impacts and Mitigation Provided by General Plan Policy

Appendix G of the CEQA Guidelines indicates that significant impacts on water supply would occur if implementation of the proposed project:

- substantially depletes ground water resources;
- interferes substantially with groundwater recharge; or
- encourages activities which result in the use of large amounts of water.

Implementation of the General Plan has the potential to increase the population of the Planning Area from 26,291 persons to 153,511 persons, a net increase of 127,220 persons. Based on water consumption rates contained in the Water Master Plan for the City of Coachella, General Plan build out would result in an additional demand on residential, commercial, and industrial water.

At buildout, the incremental change between existing and buildout water demand was calculated and is shown in Table 3.10-2, Additional Water Demand. The table indicates that potential growth associated with implementation of the General Plan would result in increased water consumption for urban uses. This effect is substantially offset, however, by a reduction in agricultural water consumption as agricultural lands (more water intensive) are converted to urban uses (less water intensive) resulting in

a net increase in water consumption of 12,110,804 gallons per day throughout the area. In order to offset this increase, the General Plan recognizes that there is a need for water management given the existing overdraft condition. Consequently, the General Plan contains management policies which are intended to secure a reliable supply of water for both domestic and agricultural uses throughout build out of the plan. Various policies are discussed throughout this section.

Table 3.10-2 Additional Water Demand (Buildout less Existing)			
Land Use	Acres/Rooms	Demand Factor ^{1,2}	Change in Usage (GPD)
Residential ³	16,770.0	1,121 (GPD/AC)	18,804,754
Golf Course	1,350.0	6,696 (GPD/AC)	9,039,060
Hotel ⁴	7,125	720 (GPD/RM)	5,130,000
Commercial	2,260.6	3,500 (GPD/AC)	7,912,100
Industrial	4,581.1	3,500 (GPD/AC)	16,033,850
Agriculture	-7,274.3	6,160 (GPD/AC)	-44,808,961
Total			12,110,804

¹ Residential, Commercial and Industrial water demand factors are based on Table IV-2, Domestic Water Demands from the 1991 City of Coachella Water Master Plan. Residential factor has been weighted to reflect land use mix of 29% single family estate, 51% single family and 20% multi-family units.

² Agricultural water demand factor is based on discussions with Coachella Valley Water District using an annual demand factor of 6.9 acre-feet per acre of agricultural land.

³ Residential includes housing within Agricultural, Entertainment Commercial, and General Commercial land use categories.

⁴ Source of Demand Factor: Section Four North Sphere Project FEIR, Appendix I, September 1994. Includes Entertainment Commercial GP area, Brandenburg/Butters SP, and McNaughton SP. Assumes 25 rooms per acre.

With regard to effects on groundwater recharge, development of the Coachella General Plan including the increased amount of impermeable urban surfaces, is not likely to have a significant effect. This is true because the study area is underlain by a clay layer which inhibits nearly all surface runoff from reaching the groundwater aquifer. Consequently, since surface water in the study area is effectively separated from the groundwater basin, the addition of impermeable surfaces due to urbanization will not substantially affect the groundwater aquifers where recharge occurs.

CVWD indicates that the lower valley groundwater basin is currently in an overdraft condition which has the potential to make water unavailable for future urban and agricultural uses at build out of the Coachella General Plan. General Plan policy requires the City to cooperate with CVWD and other jurisdictions in the Coachella Valley in continuing to develop a groundwater replenishment program capable of ensuring the viability of the groundwater aquifer within the lower Whitewater basin. General Plan policy commits the City to encourage water efficiency both in the design and maintenance of City projects and as a condition of approval for private development projects. Consequently, because the City is working cooperatively to address the issue of groundwater supply on a regional basis, and because prior efforts in the upper Whitewater Basin have proven successful, impacts relating to the supply of water via groundwater resources are not anticipated to be significant.

One unique aspect of the Coachella General Plan is the proposed creation of substantial water features as a key design element within the proposed Entertainment Area. The source of water for these features is an important question and a potential water supply issue. As recommended by the geotechnical report prepared for this EIR, the perched groundwater table is a potential untapped source of water which could

be pumped and used. The existing CVWD agricultural tile drain system accomplishes much the same function in the agricultural areas south of Coachella and demonstrates one system where the collection of perched groundwater is occurring. The General Plan policy states the City's intent to coordinate with CVWD and other appropriate agencies to evaluate the feasibility of this approach while General Plan policy requires the development of a water source plan and necessary approvals from all water resource agencies before the construction of any water features in the Entertainment Area. With the inclusion of these policies, the issue of water source for Entertainment Area water features is not considered to have a significant effect.

Water supply, storage, and distribution facilities are either available or planned by the City Municipal Water Department or the CVWD to serve all areas within the project site with the exception of the Mecca Hills. To ensure that adequate water is available to projects in the Mecca Hills area, General Plan policy encourages the continuation of existing procedures whereby development projects are reviewed for water supply issues by the appropriate agencies including Riverside County and the CVWD. The Land Use Policy Diagram designates private lands in the Mecca Hills as Very Low Density Residential (2 du/acre maximum) and public lands as Open Space - Conservation. These density limitations will reduce the potential water demand in this area. Consequently, the General Plan has addressed the provision of potable water to all portions of the study area and no significant impacts are anticipated.

The City has not formally adopted a Water Master Plan to guide the comprehensive development of water supply and distribution facilities within the incorporated City nor have specific sources of funding for water infrastructure been identified. While a master plan has been developed, General Plan policy calls for the City's formal adoption of the plan and identification of a capital improvement strategy to fund water infrastructure. Therefore, because the City will have a master plan and funding strategy in place, impacts associated with water supply, storage, and distribution are not considered significant.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to water supply are anticipated as a result of General Plan implementation.

3.10.2 Wastewater

The following section is based on the 1994 Sewer Master Plan prepared for the City of Coachella by NBS/Lowry, as well as discussions with NBS Lowry Engineers, the City Engineer representing the Coachella Sanitary District, and officials of the Coachella Valley Water District and Valley Sanitary District in early 1996.

Existing Conditions

Sanitary Service Providers

A number of sanitary service providers operate wastewater collection and treatment facilities within the Coachella General Plan project area. These include the Coachella Sanitary District (CSD) which serves most of the incorporated area, the Valley Sanitary District (VSD) which serves a small area in the northern portion of the City, the Thermal Sanitary District (TSD) which serves the unincorporated community of Thermal and the Coachella Valley Water District (CVWD) which serves the balance of the unincorporated area. Existing and planned facilities within the study area are described as follows under the appropriate service provider.

Coachella Sanitary District

The Coachella Sanitary District was established in 1936 and became a separate subsidiary district of the City of Coachella in 1969. The District is the primary sanitary provider to the incorporated City and operates facilities including sanitary sewer collection lines, lift stations, a 2.8 MGD wastewater treatment plant located near the intersection of Avenue 54 and Polk Street, and an agricultural washwater disposal plant located near the intersection of Avenue 52 and Tyler Street.

The District's sanitary facilities accommodate both residential and agricultural wastewater. The relatively high average persons per household in Coachella (4.75 compared with a County Average of 3.02)¹⁴ is reflected in the flow contributions further delineated below. The District's large agricultural users are comprised mainly of food processing plants and one munitions manufacturer.

For the most part, the existing sewer collection system is composed of small diameter pipe with larger diameter pipes serving as interceptors at Harrison and Highway 111; east to west between Avenue 52 and Avenue 53; parallel to the stormwater channel north of Avenue 54; and in Avenue 54 from Van Buren to the existing wastewater treatment plant (WWTP). According to the District, the existing sewer system has been working without any problems, and has been regularly maintained.

The District currently operates two lift stations, the High School Lift Station and the Thermal Lift Station. The High School Lift Station is located on the High School Campus at the intersection of Van Buren Street and Airport Boulevard. It handles wastewater flows from the Coachella Valley High School, Westside Elementary School, and portions of the Thermal area, and is estimated by District personnel to be near maximum capacity with an estimated flow of approximately 125,000 gallons per day. The Thermal Lift Station is described under the Thermal Sanitary District which occurs later in this section.

The Coachella Sanitary District currently operates a wastewater treatment plant (WWTP) located south of Avenue 54 on the west side of the Coachella Storm Channel. The WWTP consists of headworks with influent wetwell, screening, and raw sewage lift station; two modified activated sludge units with secondary clarifiers; an effluent metering station; a chlorine contact chamber; a dechlorination station prior to discharge to the Coachella Storm Water Channel along with a series of sludge dewatering beds. These treatment processes have a design capacity of 2.0 MGD. To increase treatment capacity, the City added a stabilization pond system with floating aerators. This treatment process has effectively added 0.8 MGD of treatment capacity, bringing the City's current available treatment capacity to 2.8 MGD. The ponds also have the capacity of pumping effluent to irrigated pastures south of the plant. In 1994 when the Master Plan was completed, average daily flow to the plant was 1.9 MGD or 68% of capacity¹⁵.

In addition to its existing domestic WWTP, the City also operates an agricultural washwater disposal operation. The disposal area consists of 12 acres which receive agricultural flows, mostly food processing plant wastewater from Sun Date, Great Date and Sun World plants. The wastewater is conveyed to the agricultural washwater treatment facility via pipeline where it is disposed of on-site by means of furrow irrigation of pasture. The 12 acre site has the capacity to treat a peak month of 175,000 gallons per day.¹⁶

¹⁴ California Department of Finance, 1995

¹⁵ Sewer Master Plan for the City of Coachella, NBS Lowry Engineers, May 1994

¹⁶ *Ibid.*, p. 4-1

At build out, the District's two wastewater treatment plants will discharge an increased volume of treated effluent and the lack of District owned land to construct percolation basins large enough to overcome the perched groundwater table will require continued discharge to the Channel as the likely choice of disposal. Because both plants will discharge to the Coachella Storm Water Channel, and ultimately flow to the Salton Sea, the District will be required to upgrade and reapply for its National Pollution Discharge Elimination System (NPDES) discharge permits as it expands. At that time, if the NPDES permit requirements become more restrictive, the District may have to apply advanced wastewater treatment to achieve the stricter limitations.¹⁷

The immediate reuse of wastewater will be the continued irrigation of the 20 acres of pasture land at the south end of the industrial treatment plant without any modification to the treatment process. Discharge Order No. 90-033 allows the discharger a peak week average daily flow of 400,000 GPD from the activated sludge treatment plant to the pasture which could reduce the cost of discharging to the Whitewater River. Future wastewater reclamation may include golf course irrigation or landscape irrigation of highways which will require the effluent to meet Title 22 requirements. Another method of effluent reuse/disposal that the City may consider would be the irrigation of local agriculture if an appropriate private party agreement can be completed.

The 1994 Sewer Master Plan makes a number of recommendations with respect to treatment facility expansions and/or upgrades necessary to accommodate future growth. These include 1) the continued use and expansion of the existing 12 acre agriculture washwater treatment operation on Avenue 52, 2) expansion of the existing WWTP, including the acquisition of 40 acres adjacent to the existing facility and the installation of a sludge dewatering belt filter press system, to increase it's capacity to 12.8 MGD, 3) construction of a new WWTP with a treatment capacity of 18.3 MGD (potentially located on 31 acres south of Avenue 54), and 4) construction of a new lift station with an initial 2.0 MGD capacity and which is ultimately expandable to 6.5 MGD. The Master Plan also recommends that the City should expand its existing plant on an interim basis until future development dictates where a new facility should be constructed.

Thermal Sanitary District

The Thermal Sanitary District is a special district which provides wastewater collection and treatment service within the unincorporated community of Thermal. The Thermal Sanitary District contracts with the Coachella Sanitary District for collection and treatment services, but is planned for annexation into the Coachella Valley Water District in early 1997.

The CSD operates the Thermal Lift Station, located immediately south of Airport Boulevard in Thermal, which pumps wastewater from the Thermal Sanitary District directly to the existing CSV wastewater treatment plant via approximately 7200 linear feet of 8-inch diameter PVC force main. The lift station is currently pumping an estimated 150,000 gallons per day. The CSD Master Plan estimates that the lift station has an effective design capacity of 300,000 gallons per day using one pump as the primary with a second pump as an emergency backup and assuming the pumps operate a maximum of 12 hours per day. The Thermal Lift Station is presently operating at 50 percent capacity and is capable of handling approximately 150,000 gallons per day of additional flow.¹⁸

¹⁷ *Ibid.*, p. 9-1

¹⁸ *Ibid.*, p. 3-1,2

Valley Sanitary District

The Valley Sanitary District (VSD) is a special district that serves the City of Indio and its immediate environs. The District's facilities include sanitary sewer collection lines, lift stations, and a 6.2 MGD wastewater treatment plant located south of the Interstate 10 Freeway at the intersection of Van Buren and Avenue 46 outside the study area boundary.

The VSD service area includes several comparatively small portions of the incorporated City of Coachella, one located at the southeast corner of Avenue 48 and Jackson Street (NW 1/4 and W 1/2 of the NE 1/4, Section 36, T5S, R7E) and comprising approximately 240 acres and the other located at the southeast corner of Avenue 50 and Jackson Street (W 1/2 of the NW 1/4 of Section 1, T6S, R7E) and comprising approximately 80 acres. There is presently no physical development in either of these areas but the VSD is prepared to extend service at such time as development occurs. Existing lines are available at all locations. In addition to these areas, the VSD provides sanitary service to the Fantasy Springs Casino via contract with the Cabazon Band of Mission Indian. VSD is available, if requested, to serve the additional Tribal lands west of Harrison Street that lie within its service boundary. VSD operates a wastewater treatment plant with a capacity of 6.2 MGD located south of the Interstate 10 Freeway at the intersection of Van Buren and Avenue 46. This site borders the Coachella General Plan's western study area boundary. The treatment plant is currently operating at a capacity of 4.7 MGD, or approximately 76% of capacity.¹⁹ VSD is currently working on completion of a master plan for their collection and treatment system that should be completed by the end of 1996.

Coachella Valley Water District

In addition to operating water supply/distribution facilities and drainage facilities, the Coachella Valley Water District provides wastewater collection and treatment services within the Coachella General Plan project area. The District's wastewater facilities include sanitary sewer force mains and a 4.35 MGD wastewater treatment plant located at the southeast corner of Avenue 62 and Filmore Street immediately outside the Coachella General Plan Study Area boundary.

CVWD's Wastewater Reclamation Plant No. 4 is sited on 300 acres of land owned by the district. The existing reclamation facility occupies approximately 120 acres of land and uses an aerated lagoon system of treatment with 6 aeration lagoons, 6 settling lagoons, 6 polishing lagoons, along with chlorination and dechlorination processes to treat effluent before release to the Coachella Valley Stormwater Channel. Treated effluent is discharged in compliance with federal permit requirements (NPDES No. CA0104973) and, of the three levels of wastewater treatment (i.e., primary, secondary, and tertiary), achieves a secondary level of treatment.²⁰

The existing facility has a treatment capacity of 4.35 MGD and is operating near capacity. Consequently, construction of an additional 40 acre lagoon module consisting of 2 aeration, 2 settling and 2 polishing lagoons is underway to increase the plant's capacity to 5.8 MGD. Completion of construction is anticipated by late 1996 and will provide capacity through the year 2000. In anticipation of future capacity requirements, CVWD is planning additional improvements beginning in 1997. While the District owns a significant amount of land at this location and has ample room to expand the facility, CVWD anticipates that future improvements will focus on the addition of clarifiers and other equipment needed to convert from an "aerated lagoon" to an "activated sludge" process of treatment. The conversion to an activated sludge process would increase efficiency from the existing ponds and allow the District to meet higher levels of treatment with the potential for water reuse rather than discharge to the Coachella Valley Stormwater Channel. By way of comparison, the District's activated sludge plant

¹⁹ Personal Communication, Dan Cain (Valley Sanitary District) with Paul DePalatis (SPF), May 1996

²⁰ Personal communication, Eric Wessels (CVWD) with Paul DePalatis (SPF), May 1996

at Palm Desert has a capacity of 18 MGD on 40 acres of land versus 5.8 MGD on 160 acres of land for the aerated pond facility described above. CVWD's Wastewater Reclamation Plan No. 4 is anticipated to serve all areas up gradient from the facility and east of Palm Desert with an ultimate design capacity of 30 MGD. If, for management reasons, the Palm Desert plant should be closed, CVWD's Wastewater Reclamation Plant No. 4 would be designed with an ultimate capacity of 50 MGD to handle the additional flows as well.²¹

To transport effluent to the reclamation plant, CVWD operates an 18" diameter Mid Valley Force Main No. 1 which runs east on 58th Avenue, south on Jackson Street, then east on Avenue 60 where it ultimately terminates at the CVWD reclamation plant. A new 18" diameter force main, the Mid Valley Force Main No. 2, is planned for construction by the end of 1996 which will extend south from Avenue 50 along Jackson Street, east on Airport Boulevard, then south on Polk Street to the reclamation plant.²² These two lines will provide backbone collection service throughout the unincorporated areas south of Coachella up to a capacity of approximately 12 MGD.²³ Once this flow level is reached, additional force mains or the construction of larger gravity sewer collection lines will be needed.

The Sewer Master Plan contains a number of factors for determining wastewater generation based on the flow contribution per acre by land use type. Utilizing these generation factors and the existing land use acreage described in Section 3.1, current wastewater generation was calculated and is summarized in Table 3.10-3, Existing Wastewater Generation, shown below. Current wastewater generation for the study area is estimated to be approximately 3.4 MGD per day for all uses.

Table 3.10-3 Existing Wastewater Generation			
Land Use	Acreage	Generation Factor (GPD/acre) ¹	Existing Wastewater (GPD)
Residential	1,380.8	798	1,101,878
Commercial	223.4	3,000	670,200
Industrial	478.9	3,500	1,676,150
Total			3,448,228

¹ Source: Residential, Commercial and Industrial sewer generation factors are based on Exhibit II, Flow Contribution by Zoning Classification from the 1994 City of Coachella Sewer Master Plan. Residential factor has been weighted to reflect land use mix of 78% single family and 22% multi-family units.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate wastewater facilities could not be provided to serve projected development. In addition, increases in wastewater generation which would exceed treatment capacity is considered a significant impact.

²¹ Ibid.

²² Personal Communication, Bruce Clark (CVWD) with Paul DePalatis (SPF), April 1996

²³ Eric Wessels (CVWD), May 1996

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan has the potential to increase the population of the Planning Area from 26,291 persons to 153,511 persons, a net increase of 127,220 persons. Based on wastewater generation factors contained in the Coachella Sanitary District Sewer Master Plan, General Plan build out would result in additional residential, commercial, and industrial wastewater flows as shown in the following Table 3.10-4, Additional Wastewater Generation:

Table 3.10-4 Additional Wastewater Generation (Buildout less Existing)			
Land Use	Acres/Rooms	Generation Rate ¹	Added Wastewater (GPD)
Residential ²	16,770	646 (GPD/AC)	10,833,420
Golf Course ³	22	2,781.8 (GPD/AC)	61,200
Hotel ⁴	7,125	120 (GPD/RM)	855,000
Commercial	2,260.6	3,000 (GPD/AC)	6,781,800
Industrial	4,581.1	3,500 (GPD/AC)	16,033,850
Total			34,565,270

¹ Source: Residential, Commercial and Industrial sewer generation factors are based on Exhibit II, Flow Contribution by Zoning Classification from the 1994 City of Coachella Sewer Master Plan. Residential factor has been weighted to reflect land use mix of 29% single family estate, 51% single family and 20% multi-family units.

² Residential includes housing within Agricultural, Entertainment Commercial, and General Commercial land use categories.

³ Assumes wastewater generated from clubhouse of 2781.8 GPD/acre and an average of 5.5 acres per clubhouse. Source: Section Four North Sphere Project Final EIR, Appendix I, September 1994. This report assumes one clubhouse per golf course.

⁴ Source of Demand Factor: Section Four North Sphere Project Final EIR, Appendix I, September 1994. Includes Entertainment Commercial GP area, Brandenburg/Butters SP, and McNaughton SP. Assumes 25 rooms per acre.

As shown, the project is estimated to generate an additional 34.6 MGD of wastewater at General Plan build out within the study area for a total wastewater generation of 38.0 MGD at buildout. This compares to an ultimate wastewater treatment design capacity of 31.1 MGD for the Coachella Sanitary District and 30 MGD minimum for the Coachella Valley Water District Water Reclamation Plant No. 4. Therefore, it is anticipated that project-generated sewage demand would be well under capacity at build out.

With increased development and population growth, maintaining adequate treatment plant capacity is important, especially since the presence of a shallow perched water table within the Coachella area makes the use of individual on site disposal systems generally undesirable. To ensure the availability of adequate treatment capacity, General Plan policies require the City to coordinate with other local sanitary service providers to ensure that planning and funding tools are in place for the construction of adequate facilities to meet increased wastewater demands. The potential for shared treatment capacity between service providers is also an available management option as demonstrated by the Coachella Sanitary District and Thermal Sanitary District. The large amount of land controlled by the Coachella Valley Water District around their existing treatment facility gives ample opportunity for any necessary expansion to meet capacity demands. For these reasons, the provision of wastewater treatment capacity is adequately addressed and is not considered to be a significant impact.

Since the Coachella area contains a shallow perched water table, the use of individual on site wastewater disposal systems poses a potential health risk in the valley area. To address this issue, General Plan General Plan policy requires the City to abate illegal onsite disposal systems within the City and to require remediation of inadequate or substandard systems on properties seeking annexation to the City,

General Plan policy requires that all new projects which propose individual on site wastewater disposal systems be reviewed and approved by the Riverside County Environmental Health Department, the City Council, the Coachella Sanitary District, the Coachella Valley Water District, and the Regional Water Quality Control Board, and General Plan policy, which requires the City's continued participation in the NPDES stormwater program which includes surface water quality monitoring provisions. Because of these policies, the issue of health risk due to existing and future onsite disposal systems is determined not to have a significant impact.

The Coachella Sanitary District has not formally adopted a Sewer Master Plan to guide the comprehensive development of sewer collection and treatment facilities within the incorporated City nor have specific sources of funding for wastewater infrastructure been identified. While a master plan has been developed, General Plan policy calls for the City's formal adoption of the plan and identification of a capital improvement strategy to fund wastewater infrastructure. The VSD is nearing completion of its Master Plan and the CVWD has ongoing master facility planning procedures in place. Therefore, because the long range master planning and funding strategies will be in place, impacts associated with the coordination and upgrade of wastewater collection and treatment facilities are not considered significant.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to wastewater collection and treatment are anticipated as a result of General Plan implementation.

3.10.3 Solid Waste

Existing Conditions

Per California Assembly Bill 939, which became law on January 1, 1990, all cities and counties must have a waste stream source reduction and recycling plan which reduces waste sent to landfills 25% by 1995, and 50% by the year 2000. These plans were required to be completed by July 1, 1991. The City of Coachella has a curbside recycling program for single family residences and have expanded it throughout the entire city. The City does not currently have a recycling program for multi-family residences or commercial establishments.

According to a study prepared for Riverside County²⁴, the incorporated City of Coachella generated approximately 30,000 tons of solid waste in 1990, of which about 57 percent was diverted from the waste stream through recycling and composting.

The City of Coachella currently contracts with Western Waste Industries (WWI) for solid waste collection and disposal services. WWI has curbside recycling programs for single family residences along with voluntary programs. No recycling program for multi-family residences or commercial establishments are currently in operation. Currently, WWI estimates a diversion rate of approximately 61%.

Solid waste generated by the City that is not otherwise diverted is disposed of in Riverside County landfills. The nearest active municipal landfill to Coachella is the Coachella Landfill, located at 87-011 Avenue 44 just east of the Coachella city limits and within the planning area. This landfill receives approximately 700 tons of solid waste per day and is scheduled for closure in December of 1996. When the Coachella Landfill is no longer available for service, the Edom Hill Landfill, located

²⁴ CH₂M Hill, Riverside County Waste Generation Study, June 1991

at 70-100 Varner Road in Cathedral City will be used. Edom Hill landfill receives an average of 700 tons of solid waste per day and has a remaining lifetime of approximately five years. The projected closure date for the Edom Hill Landfill is in July of the year 2001. When Edom Hill closes, Western Waste would likely use the Mesquite Landfill located south of the planning area in Imperial County. This facility was approved for operation in 1995 and is owned by Western Waste. Other landfills which would be within their disposal radius (200 miles) include the La Paz landfill located in Arizona northeast of Blythe, and the El Sobrante landfill located in Corona.

A number of companies have submitted proposals to the Coachella Valley Association of Governments (CVAG) to build a waste transfer station in the lower Coachella Valley at a site to be determined. This project would include modified Material Recovery Facility (MRF) capabilities aimed at separating specific waste streams for recycling. It should also be noted that the County of Riverside is considering the 640 acres purchased at closure of the Coachella Landfill as a potential MRF site.²⁵

Table 3.10-5 Existing 1996 Solid Waste Generation		
<u>1996 Population</u>	<u>Generation Rate*</u> (lbs/person/year)	<u>Generation</u> (tons/year)
26,291	2.27	30

* Generation Rates derived from City of Indio General Plan 2020 EIR.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate solid waste facilities could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan has the potential to increase the population of the Planning Area from 26,291 persons to 153,511 persons, a net increase of 127,220 persons. This population increase would result in a net increase of 144 tons per year in the area's solid waste generation.

Table 3.10-6 Additional Solid Waste Generation		
<u>Additional Population</u>	<u>Generation Rate*</u> (lbs/person/year)	<u>Generation</u> (tons/year)
127,220	2.27	144

* Generation rates derived from the City of Indio General Plan 2020 EIR.

²⁵ Sung Key Ma

One effect of increased solid waste generation will be the need for expanded waste collection services. Policies proposed by the General Plan as well as the continuation of existing protocols should adequately address this issue. General Plan policy requires the City to provide for adequate solid waste removal (including recyclables), installation and maintenance of trash receptacles in public areas and regular street sweeping. Representatives of WWI do not anticipate any difficulty in meeting current and future needs of the City relating to solid waste collection and recycling. Waste collection operations and equipment would be expanded in response to increased demand. For these reasons, the project will not have a significant impact on waste collection in the study area.

Added pressure on municipal solid waste landfills will also result from increased solid waste generation. General Plan policies have been developed to address this issue. General Plan policy encourages reduction of solid waste generation and an increase in recycling to be implemented through the City's mandatory Source Reduction and Recycling Element. General Plan policy encourages the City to coordinate with local waste haulers, Coachella Valley Association of Governments, and the Riverside County Waste Management Department to maximize the extended use of existing landfills serving the City. General Plan policy encourages the use of recycled materials in products and services obtained through City purchases and contracts. Because the General Plan commits the City to support solid waste reduction in various forms and because the State's diversion goals are being met, impacts on landfills, while unavoidable, are deemed mitigable to a point of insignificance.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to solid waste are anticipated as a result of General Plan implementation.

3.10.4 Natural Gas

Existing Conditions

The Gas Company (TGC) provides service to the City of Coachella and the Study Area. As a public utility, TGC is under the jurisdiction of the California Public Utilities Commission and may also be affected by actions of federal energy regulatory agencies. TGC provides service in accordance with policies and extension rules on file with the California Public Utilities Commission.

Regional natural gas lines crossing the area include two 30-inch lines and a 36-inch line located along the powerline corridor within the Mecca Hills. Gas lines are frequently equipped with devices to evacuate natural gas from pipelines and equipment which can result in loud noise events. (A discussion of noise related to this topic is found in Section 3.7)

Natural gas transmission lines are subject to review and permitting by the Public Utility Commission. Natural gas lines are not subject to review by local jurisdictions.

An estimate of existing natural gas consumption for the Study Area is shown in Table 3.10-7. As shown, current consumption is approximately 455,955,445 cubic feet per year.

The Planning Area also contains two major petroleum transmission lines adjacent to the Southern Pacific Railroad tracks. These high pressure lines are 20-inches and 12-inches in diameter and run from Texas to San Pedro, California.

Table 3.10-7
Natural Gas and Electrical Consumption - Existing Land Uses (1996)

Land Use	Quantity Units		Gas Rate (CF/Mo)	Elec. Rate (kWh/Yr)	Gas Use		Electrical Use	
					(CF/Mo)	(CF/Day)	(Kwh/Yr)	(Kwh/Day)
SF Residential	4,166	DU	6665.00	5626.50	27,766,390	912,243	23,439,999	64,175
MF Residential	1,181	DU	4012.00	5626.50	4,738,172	155,669	6,644,897	18,193
Commercial	546,600	SF	2.90	13.55	1,585,140	52,079	7,406,430	20,278
Industrial	1,191,700	SF	3.30	10.50	3,932,610	129,203	12,512,850	34,258
					Domestic Gas	1,067,912		
					Comm. Gas	181,281		
					Gas Total	1,249,193	Elec. Total	136,904

NOTES: 1. Natural gas and electric usage rates are from SCAQMD "CEQA Air Quality Handbook", 1993.

2. Land use data provided by Smith Peroni & Fox dated 5/13/96.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate natural gas facilities could not be provided to serve projected development. In addition, impacts on the provision of natural gas and other energy resources are considered significant if there is a substantial increase in demand upon existing sources of energy, or if the project requires the development of new sources of energy (CEQA Guidelines, Appendix G).

Project Impacts and Mitigation Provided by General Plan Policy

New development will result in an increase in demand for natural gas in comparison with existing conditions. Table 3.10-7 shows existing consumption while Table 3.10-8 shows the estimated consumption of natural gas at build out of the Planning Area.

As development of the project area occurs, consumption of nonrenewable energy resources will increase. Much of the energy consumed will be a non-renewable resource with finite supply such as natural gas. This represents a significant unavoidable adverse impact to non-renewable energy resources. The impact can be partially mitigated by reduction of energy consumption and by encouraging the investigation and use of alternative renewable sources of energy. However, this impact can only be mitigated to insignificance by a complete change in energy consumption habits, namely consumption of primarily renewable energy resources. Current consumption trends (dependence on fossil fuels) and the unavailability of cost competitive renewable energy alternatives put complete mitigation of this impact beyond the City's control at this time. TGC representatives have indicated that the City of Coachella can continue to be serviced from existing facilities in the area, although extension of lines in accordance with the Company's policies and extension rules on file with the CPUC may be required in some new development areas at the time contractual arrangements are made.

Since build out under any General Plan scenario other than a no-project no-development plan would increase the consumption of non-renewable energy resources, a number of policies in the General Plan have been developed which require energy conservation measures to be incorporated into new development and encourages alternate forms of energy. These include policies which encourage energy conservation in the development of new projects through proper orientation of the building, shading standards, and by incorporating into City codes planning and building standards which reduce the consumption of energy resources. The use of solar and other alternative energy sources and the development of geothermal resources as an energy source is encouraged.

General Plan policy also encourages the City to coordinate with The Gas Company to ensure the delivery and accessibility of natural gas to serve all Coachella residents and business owners and to coordinate with The Gas Company to develop standards for the sensitive visual integration of natural gas facilities within the City. General Plan policy also provides for the shared use of major transmission corridors and other appropriate measures as a means of preserving the aesthetic resources of the City and to lessen the visual impacts of such development and encourage the City to work with the appropriate agencies in developing these corridors for recreational uses.

With regard to the petroleum transmission pipeline adjacent to the Southern Pacific Railroad tracks, a significant impact could occur in the event of a train derailment, potentially resulting in fire and the release of petroleum in the area. However, the possibility of a train derailment is considered remote due to the lack of steep grades or curves along the tracks in the Planning Area. In addition, the General Plan designates most of the land adjacent to the tracks as agricultural and industrial, while the railroad right-of-way ensures that any uses that do occur are at least 100 feet from the tracks, thus minimizing any potential damage to life or property. General Plan policy also states that the City shall coordinate with

all relevant agencies in the preparation of a Multi-Hazard Functional Plan and specifically shall coordinate with the Southern Pacific Railroad and utility agencies to assess and prevent hazardous material spills and pipeline ruptures adjacent to rail lines.

Additional Mitigation and Unmitigable Impacts

No additional mitigation is proposed since all feasible energy saving policies have been incorporated into the General Plan. Despite this, implementation of the project will result in a substantial increase in demand for natural gas and therefore a significant unavoidable impact on non-renewable energy resources.

3.10.5 Electricity

Existing Conditions

Electrical service is provided to the City of Coachella by the Imperial Irrigation District (IID). The District maintains the following four substations in the study area:

- **Coachella Valley Substation** - Located at Avenue 52 and Pierce Street. It is one of the major injection points of power into the Coachella Valley's 92 KV (Kilovolt) sub-transmission network. Two transformers, each rated 150 MVA (million volt amperes), convert the voltage from 230 KV to 92 KV lines. A third transformer, rated 125 MVA, converts voltage from 161 KV to 92 KV.
- **Coachella City Substation** - Located on Highway 111 north of Avenue 52 and is a major sub-transmission station. Power is received on two 92 KV lines from the Coachella Valley Substation and rerouted over six other 92 KV lines. There are also four gas turbine generators located at this site. Each generator is rated at 20 MW (megawatts).
- **Avenue 52 Substation** - Located on Avenue 52, east of Tyler Street. It is a distribution substation with one 28 MVA transformer which converts the voltage from 92 KV to 12.47 KV.
- **Thermal Substation** - Located on Highway 111 at Avenue 50. It is a distribution substation with one 12.5 MVA transformer which converts the voltage from 92 KV to 12.47 KV.

Electrical distribution lines which transmit power range from 92 KV to 230 KV. The District is presently engaged in a project to extend a 230 KV transmission line to the Avenue 42 substation, located on Avenue 42, west of Madison Street. This project is needed to prevent potential overloads should the Coachella Valley Substation become overloaded. Southern California Edison has a major transmission corridor in the Indio Hills which contains three regional transmission lines. One 230 KV line is owned by IID, while Edison owns a 220 KV line and a 500 KV line operating along this corridor.

Table 3.10-7 summarizes the existing electrical usage for the study area. As shown, total existing electrical usage is 49,969,960 kWh per year.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate electrical facilities could not be provided to serve projected development. In addition, impacts on the provision of electricity and other energy resources are considered significant if there is a substantial increase in demand upon existing sources of energy, or if the project requires the development of new sources of energy (CEQA Guidelines, Appendix G).

Table 3.10-8
Natural Gas and Electrical Consumption - Proposed General Plan

Land Use	Quantity Units		Gas Rate (CF/Mo)	Elec. Rate (kWh/Yr)	Gas Use		Electrical Use	
					(CF/Mo)	(CF/Day)	(Kwh/Yr)	(Kwh/Day)
SF Residential	40,280	DU	6665.00	5626.50	268,466,200	8,820,245	226,635,420	620,494
MF Residential	10,217	DU	4012.00	5626.50	40,990,604	1,346,714	57,485,951	157,388
Motel	4,250	Occ.Rm.	2400.00	4975.00	10,200,000	335,113	21,143,750	57,888
General Office	89,300	SF	2.00	12.95	178,600	5,868	1,156,435	3,166
Commercial	10,289,000	SF	2.90	13.55	29,838,100	980,307	139,415,950	381,700
Industrial	50,983,000	SF	3.30	10.50	168,243,900	5,527,520	535,321,500	1,465,630
					Domestic Gas	10,166,959		
					Comm. Gas	6,848,808		
					Gas Total	17,015,767	Elec. Total	2,686,267

NOTES: 1. Natural gas and electric usage rates are from SCAQMD "CEQA Air Quality Handbook" (11/93).
2. Land use data provided by Smith Peroni & Fox dated 10/2/96. Assumes 500 SF/Motel Room.

Project Impacts and Mitigation Provided by General Plan Policy

New development will result in an increase in demand for electricity in comparison with existing conditions. Table 3.10-7 shows existing electric consumption while 3.10-8 shows estimated consumption at build out of the Planning Area.

As development of the project area occurs, consumption of nonrenewable energy resources will increase. Much of the energy consumed will be in the form of electrical energy which is produced largely from a non-renewable resource. This represents a significant unavoidable adverse impact to non-renewable energy resources. The impact can be partially mitigated by reduction of energy consumption and by encouraging the investigation and use of alternative renewable sources of energy. However, this impact can only be mitigated to insignificance by a complete change in energy consumption habits, namely consumption of primarily renewable energy resources. Current consumption trends (dependance on fossil fuels) and the unavailability of cost competitive renewable energy alternatives put complete mitigation of this impact beyond the City's control at this time.

IID has indicated that their next major planned transmission project will be needed in ten to fifteen years based on current population and load growth projections. This project is the conversion of the existing 161 KV transmission line (which connects Coachella Valley Substation and Avenue 58 substation to Imperial Valley) to 230 KV operation. The District has indicated that once these projects are completed, there will be sufficient major transmission capacity to serve the City of Coachella and its sphere of influence. The District has sufficient facilities to serve the existing load and facilities would have to be expanded as the load base expands.

Since build out under any General Plan scenario other than a no-project no-development plan would increase the consumption of energy resources, a number of policies in the General Plan have been developed which require energy conservation measures to be incorporated into new development and encourages alternate forms of energy. These include policies which encourage energy conservation in the development of new projects through proper orientation of the building, shading standards, and by incorporating into City codes planning and building standards which reduce the consumption of energy resources. The use of solar and other alternative energy sources and the development of geothermal resources as an energy source is encouraged.

A General Plan objective is to provide adequate electric utilities to serve the community. General Plan policy encourages the City to coordinate with the electric utility regarding the effects of electromagnetic fields (EMF) produced by high voltage electrical facilities, to evaluate alternative energy sources to augment traditional forms of energy production and usage, and to develop standards for the sensitive integration of electrical facilities within the City. General Plan policy requires the City ensure new development projects install all on-site utilities and connections to distribution systems underground.

General Plan policy encourages the City to coordinate with the electric utility to identify the location of future high voltage corridors and encourages the City to work with the appropriate agencies in developing existing and future corridors for recreational use. General Plan policy provides for the shared use of major transmission corridors and other appropriate measures as a means of preserving the aesthetic resources of the City and to lessen the visual impacts of such development.

Additional Mitigation and Unmitigable Impacts

No additional mitigation is proposed since all feasible energy saving policies have been incorporated into the General Plan. Despite this, implementation of the project will result in a substantial increase in demand for electricity and therefore a significant unavoidable impact on non-renewable energy resources.

3.10.6 Telephone and Cable Television

Existing Conditions

Telephone and cable services for the project area are provided by General Telephone and Electric Company of California (GTE) and Continental Cablevision (Continental) respectively. GTE currently provides service to the Planning Area. Existing telephone and cable television facilities provide service to all developed areas of Coachella via a combination of underground and overhead lines. Services are provided on a demand basis. GTE currently serves the Planning Area from facilities located in Coachella, Thermal, and La Quinta. Future facilities are provided on a project by project basis as demand increases. To cover the cost of line extensions, GTE requires the payment of additional fees in areas that are 1,000 feet or greater from an existing line or to certain types of Commercial projects. With appropriate notice, the extension of telephone service can be provided subject to GTE's cost recovery rules.²⁶

Continental currently maintains over 43 miles of cable (20 aerial and 23 underground) which passes 4,500 residences and serves 2,700 customers in the City of Coachella. Continental has plans to upgrade the cable television system during the latter part of 1996. This is scheduled for completion by the end of 1997 and will increase the capacity from the existing 36 channels to 116 channels. They also plan to deploy substantial amounts of fiber optic cable in conjunction with the rebuild project in Coachella, providing significant improvement in signal quality and system reliability. The franchise agreement between Continental Cablevision and the City requires that cable service must be provided to areas with a minimum of 40 dwelling units per cable route mile and which total at least 20 dwelling units. Service will be extended as needed when franchising requirements are met.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate telephone, and cable television facilities could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Buildout of the project area will add to the overall demand for telephone and cable television services and require the extension of these facilities into areas which are presently unserved. Existing protocols within the telephone and cable companies, along with General Plan policies are anticipated to address these issues sufficiently. General Plan policy provides for coordination between the City and GTE to ensure comprehensive, uninterrupted communication services and facilities for the City's residents. General Plan policy requires that all new development and redevelopment projects be served with underground communication facilities. General Plan policy encourages the City to coordinate with cable television providers to execute franchise agreements in order to serve the City with additional television programming. In addition to these policies, representatives of GTE and Continental have indicated their commitment to expanding service within the project area as demand dictates. Consequently, the extension of telephone and cable television facilities to serve the project area is not anticipated to be a significant impact.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to telephone and cable television services are anticipated as a result of General Plan implementation.

²⁶ Personal communication, Bill Morrow, Engineer (GTE) with Ginger Nuhn (SPF), June 1996

3.11 Public Services

3.11.1 Law Enforcement

Existing Conditions

The Planning Area consists of both the incorporated City of Coachella and an unincorporated area of Riverside County, and is therefore under the jurisdiction of the City of both the Coachella Police Department and the Riverside County Sheriff's Department. The Coachella Police Department will provide service to any unincorporated portions of the Planning area which are annexed to the City in the future.

The City of Coachella Police Department operates out of a single facility located at 1280 Grapefruit Boulevard in Coachella with response times of about three minutes for emergency calls. The Department currently has 25 sworn officers and 9 non-sworn personnel. Two of the officers are restricted to the provisions of State and County grants and don't perform general police functions. These two officers mainly perform public relations duties such as bike patrol and dealing with juveniles in drug and alcohol awareness programs such as D.A.R.E. Based on a City population of 20,800 (Department of Finance, January 1995) there are approximately .96 officers per 1,000 residents of the City. This is short of the Department's goal of 1.3 officers per 1,000 residents by about 7 officers. The City of Coachella Police Department funding is allocated through the City's General Fund which comes primarily from sales and property taxes.

To provide police services, the Coachella Police Department divides the city into three geographical patrol districts (beats). Currently the Department fields an average of two officers on patrol and one supervisor on each shift. The desired level is an average of three officers and a supervisor on each shift.

The Riverside County Sheriff's Department provides limited service to the unincorporated portions of the Planning Area from its Indio Station located at 82-695 Doctor Carreon Boulevard. The Station's area of service is divided into "beat areas" and operates on a 24 hour per day basis for response to service calls. Currently, the Indio Station is staffed with 49 Deputy Sheriffs, six Investigators, eight Sergeants, two Lieutenants, one Captain, seven Forensic Technicians, eight Sheriff Service Officers, two Office Assistants, one Accounting Technician, and one Crime Analyst. Of these positions, the unincorporated area is served by 20 Deputy Sheriffs, and a portion of the administrative staff. Support services include Emergency Services, K-9, Forensic Services, Aviation Unit, Hostage Negotiation, Hazardous Device Team, Underwater Recovery Team and other specialized teams. The following services are provided in the field: response to calls, follow-up investigation, limited patrol, and limited traffic control. Response time in the unincorporated area averages about nine minutes for routine calls and eight minutes for emergency calls.

Current funding for the Sheriff Department is provided by the County of Riverside. The ratio of staff funded by the County is .85 deputies per 1,000 persons. The Southern Coachella Valley Community Services District provides supplemental Sheriff services to the district area on a cost recovery basis. Residents and property owners pay for these services with an additional parcel charge collected via the property tax system. Additional funding is provided by COPPS grants funded by the Federal Government.

The Sheriff Department utilizes a planning standard of 1.5 deputies per 1000 population to forecast additional public safety personnel requirements. Because the current ratio of staff funding by Riverside County is only .85 deputies per 1,000 population, the department is slightly understaffed. Based on an estimated 1996 population of 5,518 persons in the unincorporated portion of the study area, this would result in a deficiency of approximately 3.6 deputies.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate law enforcement services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the proposed General Plan will create additional demands on police services due to potential increases in new commercial, industrial and residential uses.. It is anticipated that future development resulting in higher assessed property valuation will adequately support future police department funding. However, development will be evaluated on a project specific basis and it may be necessary to impose development impact fees on new construction at some point. Currently, the City of Coachella Police Department does not staff homicide investigators, forensics, canine, or swat team services. These services are borrowed from the Riverside County Sheriff Department, which has expressed a concern that the Coachella Police Department should become a full service facility and provide their own staff in the future.¹

The Police Department has implemented a Community Oriented Policing and Problem Solving (COPPS) law enforcement system which focuses on problem solving and crime prevention rather than primarily responding to calls and engaging in suppression activities. This system is designed to prevent crime through community involvement. As budget and personnel become available, the following activities and services will be implemented:

- Citizens on Patrol
- Neighborhood Watch
- Business Watch
- Volunteers in Policing
- Gang and Narcotic Detail

The General Plan incorporates numerous policies to ensure the provision of adequate law enforcement services. General Plan policy provides for the continued research and promotion of building design as a means to decrease crime. General Plan policies require the City to work toward maintaining adequate police protection capabilities and achieve a high standard of police protection to adequately serve the City at full buildout. General Plan policy requires the City to encourage, facilitate and participate in, where appropriate, the continued conduct of programs for the training of police and fire personnel to be responsive and sensitive to the needs of all Coachella's residents while maintaining a high level of service and protection. General Plan policy encourages the City to participate in Mutual Aid Agreements with adjacent cities, Riverside County, the State of California, and the various federal agencies to provide cooperative police assistance in emergency situations. General Plan policy requires the City to develop an Emergency Preparedness Plan to better facilitate the distribution and coordination of the City's resources (i.e., police, fire, paramedic, etc.) on the local, regional, and State level (if necessary) during an emergency situation. It is anticipated that General Plan Policies will fully mitigate any impacts to police services as a result of General Plan implementation.

Additional Mitigation and Unmitigable Impacts

Current procedures along with General Plan policies are anticipated to provide adequate mitigation against potential impacts and no further mitigation is necessary. No unmitigable significant adverse impacts related to the provision of police services are anticipated as a result of General Plan Implementation.

¹ Lt. Pittman, Riverside County Sheriff, Indio Office, personal communication with Ginger Nuhn, Smith, Peroni & Fox, June 3, 1996.

3.11.2 Fire and Paramedic Services

Existing Conditions

The City of Coachella currently contracts with the Riverside County Fire Department for fire protection services and emergency medical services. Station 79, located at 1377 Sixth Street in Coachella, serves the incorporated City. The City owns two Type One Engines, one 3,000 gallon Water Tender, and one mini-pumper/squad which are leased to the County. Additional equipment consists of one command vehicle. Paramedic services are provided by a private company (Springs Ambulance Service). The County can also provide firefighter/paramedic services if the City wishes to contract for this service.

Personnel at the Coachella station consists of one Fire Captain, 4.2 engineers and 2.6 firefighters. In ideal low-traffic conditions all service areas within one mile radius from the station have a response time of two minutes and all areas within a two to five mile radius have a three to five minute response time.

Minimum fire flow requirements for Multi-Family residential development is 2,500 gallons per minute (GPM), for Commercial is 4,000 GPM and for Heavy Industrial is 5,000 GPM.

There is one other fire station within the planning area located at the Thermal Airport which is Riverside County Fire Station 39. Station No.70 including Springs Ambulance Service is located at Avenue 54 and Madison Street in La Quinta approximately. Through mutual aid agreements, this station and others adjacent to the planning area would provide backup assistance for any major events or multiple events that may occur within the City.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate fire protection services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the proposed General Plan will create additional demands on fire services due to potential increases in new commercial, industrial and residential uses. To address this issue, the General Plan contains policies which will ensure that these services are provided. A stated goal of the General Plan requires the City to provide fire services in a manner and number to ensure a safe and secure environment for those living, working, or visiting the community. General Plan policy encourages continued participation in mutual aid agreements with surrounding jurisdictions in order to increase service capabilities for major fires and other disasters. General Plan policy provides for the establishment of safe firefighting facilities of adequate size and best location to provide for acceptable (5 minutes or less) response times. New urban development should occur only where necessary emergency services can be provided with an acceptable response time unless otherwise mitigated (e.g., sprinklers). The City shall continue to assess the need for fire services and develop new stations when and where they are needed.

Supplementing the City's commitment to provide adequate staffing and facilities, other policies in the General Plan are designed to reduce the risk of potential fire hazard. General Plan policy provides for the continued regulation and enforcement of fire protection water system standards for all new construction projects built within the Planning Area including the installation of fire hydrants and fire sprinkler system and the provision of adequate fire flow. For development in areas with 10 percent or greater slopes, special on-site fire protection measures shall be specified during project review to reduce the potential fire hazard. General Plan policy requires the City to promote public awareness of fire and

emergency procedures by expanding existing and developing new public fire safety and emergency life support education programs. Consequently, the water delivery system and other procedures will reduce the risk of fire hazard and no significant unmitigable impacts are anticipated.

Additional Mitigation and Unmitigable Impacts

Current procedures along with General Plan policies are anticipated to provide adequate mitigation against potential impacts and no further mitigation is necessary. No unmitigable significant adverse impacts related to the provision of fire protection services are anticipated as a result of General Plan implementation.

3.11.3 Parks and Recreation

Existing Conditions

The Study Area is within the Coachella Valley Recreation and Park District. The District administers many of the programs that operate within City-owned parks. Such programs include both adult and youth recreation and sports programs.

Parks within the project area include a "Tot-Lot" at Avenue 50 and Calle Empalme containing .21 acres and consisting of children's play equipment; De Oro Park located at Avenue 50 and Avenida De Oro which consists of 4.04 acres and contains a baseball field and picnic areas; Sierra Vista Park located at Tyler Street and Calle Mendoza which consists of 2.6 acres and provides basketball courts, picnic areas and general recreation; Dateland Park located adjacent to Bobby Duke School on Bagdad Avenue at Shady Lane which consists of 4.03 acres and has a baseball diamond, tennis court, soccer field and picnic areas; City Hall Park which consists of 5 acres and contains a swimming pool, picnic areas, and playground equipment; and the ten-acre Bagdouma Park, located at the intersection of Bagdad Avenue and Douma Street. This facility features a baseball diamond and a large general recreation area. In addition, there are also eight school sites which have various playground equipment and playing fields which also serve recreational needs. Assuming an incorporated population of 20,775 persons and a total of 48 acres of existing parkland within the City, a ratio of 2.3 acres per 1,000 residents is created which is below the City's target of 3.0 acres of parkland per 1,000 residents.

Regional park facilities in the vicinity of the Study Area include Lake Cahuilla County Park which offers swimming, fishing, boating, picnic areas, hiking and equestrian trails, and camping. This park is about one mile west of the study area at the end of Avenue 58.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate park services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan has the potential to increase the population of the Planning Area from 26,291 persons to 153,511 persons, a net increase of 127,220 persons, and will therefore create additional demands on parks and recreational facilities. The land use plan and policies contained in the Open Space and Conservation Element of the General Plan are designed to mitigate these potential impacts and provide sufficient facilities for existing and future residents.

The land use plan itself sets aside significant amounts of open space. In particular, 7,090 acres of lands are designated "Open Space-Conservation" (OS) which could be used for potential park and recreational facilities and identifies the spatial distribution of park sites on the Park and Recreation Policy Diagram.

The land use plan also incorporates several approved specific plans which contain recreational elements. These include the McNaughton Specific Plan which proposes 363 acres of onsite golf courses and open space uses; the Brandenburg and Butters Specific Plan which proposes 9.9 acres of pocket parks and a 6 acre neighborhood park site; the Rancho Coachella Vineyards Specific Plan which proposes a 15-acre combination school/park site; and the Promenade Park Specific Plan which proposes 86-acres of parks and open space.

In addition to these spatial aspects, General Plan policies are designed to set park standards and ensure the development of new parks as population increases. Specifically, General Plan policies establish standards for the provision of Neighborhood, Community, and Regional Park acreage per 1,000 residents, requires subdivision developers to provide all public parks necessary to serve their development and to pay for park expansion as deemed necessary by the City, requires continuing collection of development fees on new construction to cover capital cost of park facilities; and requires provision of public parks as a component of the Entertainment Zone. For these reasons, the provision of parkland is not anticipated to be a significant impact due to General Plan implementation.

Additional Mitigation and Unmitigable Impacts

General Plan policies cited above are anticipated to provide adequate mitigation, and no further measures are necessary. No unmitigable significant adverse impacts related to parks are anticipated as a result of General Plan implementation.

3.11.4 Schools

Existing Conditions

The majority of the project area is located within the jurisdiction of the Coachella Valley Unified School District (CVUSD). The CVUSD serves the entire City of Coachella, portions of Indio and La Quinta, as well as the unincorporated communities of Thermal and Mecca. As of January 12, 1996, the District had a total enrollment of 11,062 students with a capacity of 8,686 students. This exceeds capacity by 2,376 students which causes severe overcrowding in some schools. To make up for this shortfall, the District presently utilizes 121 temporary portable classrooms to house students. The schools in the District within the Planning Area with their enrollments and capacities are as follows:

Table 3.11-1 CVUSD Enrollment And School Capacity				
SCHOOL	GRADE	CAPACITY	ENROLLMENT	DIFFERENCE
Bobby G. Duke	K-6	720	636	-84
C.V.H.S.	9-12	1,712	2,359	+647
Cahuilla Desert Academy	7-8	990	933	-57
Westside	K-8	678	768	+90
Cesar Chavez	K-6	669	730	+61
Palm View	K-6	630	574	-57
Valley View	K-6	580	752	+172
Peter Pendleton	K-6	560	516	-42

Source: Coachella Valley Unified School District

Current funding for new school facilities is in the form of Statutory School Fees, presently set at \$1.72 per square foot of new residential development, and collection of fees for residential general plan amendments based upon a mitigation plan being developed by the CVUSD for adoption by the City.

The above amounts are also applicable when prior approvals have been conditioned on mitigating school impacts on the District. The District requires mitigation agreements to be executed prior to the granting of such legislative approval. In the past the State of California has provided supplemental funding to reduce such mitigation payments. However, the statewide need for school facilities far exceeds the ability of the State to fund such needs. Therefore, the State is no longer a reliable source for alternate funding for the school facilities needs of the District.

In addition, a portion of the study area is within the boundaries of the Desert Sands Unified School District (DSUSD). The area covered by DSUSD is generally north of Avenue 48 and west of Fillmore Street. It also includes the area north of Avenue 50 between Jackson and Van Buren Streets (Section 36). According to the District, schools which would serve residents for the portion of the Planning Area within their jurisdiction are Eisenhower Elementary School, Wilson Middle School, and Indio High School, all located in the City of Indio. The enrollment and capacities for these schools are as follows:

Table 3.11-2 DSUSD Enrollment And School Capacity				
SCHOOL	GRADE	CAPACITY	ENROLLMENT	DIFFERENCE
Indio High School	9-12	1,984	2,104	+120
Wilson Middle School	6-8	733	546	-187
Eisenhower Elementary	K-5	610	513	-97

Source: Desert Sands Unified School District

Note: All schools are outside the Coachella General Plan Study Area

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate school services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

As indicated above, many schools which serve students residing in the Planning Area are at or above capacity. Due to continued growth, the CVUSD projects a need for three new elementary schools over the next six years. The need for junior high schools will also grow beyond capacity and high school facilities already exceed design capacity. Therefore, any new development within the General Plan study area will have a significant impact upon the District, prior to mitigation. Without appropriate measures to ensure that future school facilities are adequately funded, the District will not be able to meet future student needs.

Based on the Land Use plan for the General Plan update Implementation of the General Plan has the potential to increase the number of dwelling units in the Planning Area from 5,347 to 50,497, a net increase of 45,150 dwelling units. Utilizing the CVUSD student generation factor of 1.11 students per dwelling unit in preference to the DSUSD factor as the more conservative assumption, there is the potential to generate 50,117 additional students at buildout.

Table 3.11-3, Student Generation Table for the Coachella General Plan Study Area

Grade Level		Student Generation Factors ^{1,2}	Existing Students	Potential Students Generated ^{3,4}	Total Students
DSUSD	Elementary School	0.2628	513	838	1,351
	Middle School	0.1213	546	387	933
	High School	0.1189	2,104	379	2,483
	Total	0.5030	3,163	1,604	4,767
CVUSD	Elementary School	0.6	3,837	28,384	32,221
	Middle School ⁵	0.23	990	10,881	11,871
	High School	0.28	1,712	13,246	14,958
	Total	1.11	6,539	52,511	59,050
GRAND TOTAL			9,702	54,115	63,817

1 Source: DSUSD Residential Facilities Impact Mitigation Plan, May 1994.

2 Source: CVUSD School Planning Services, November 1993.

3 Based on a total of 3,190 single family detached units within the DSUSD boundary at buildout.

4 Based on a total of 47,307 single and multi-family detached and attached units within the CVUSD boundary at buildout.

5 Westside School has grades K-8 and is included in the Elementary School total.

Policies contained in the General Plan are designed to mitigate potential impacts to the School District. These policies include that the City will coordinate with local school districts to ensure that an adequate number of elementary, middle and high schools are provided; the City requires the reservation (with a future right to purchase) of real property, pursuant to the master plan of the applicable school district, for the provision of necessary public educational facilities; develop and implement programs to assist youth in making successful transitions to adulthood; improve and increase educational opportunities for all citizens including coordinating and communicating with the local post graduate institutions (i.e., College of the Desert, Chapman College and National University) and the DSUSD and CVUSD to locate satellite classes in local district facilities to provide proximate educational opportunities for City residents.

Additional Mitigation and Unmitigable Impacts

Despite the policy mitigations contained in the General Plan, without adequate available funding sources there is still the potential that facilities and resources may not be available to serve the school needs of a growing population. Consequently, until funding sources are identified, school impacts are considered a significant, unavoidable adverse impact.

3.11.5 Health Facilities

Existing Conditions

The nearest major medical facility is John F. Kennedy Memorial Hospital (JFK) located at 47111 Monroe Street in Indio. JFK is a full-care regional medical facility with a total of 130 licensed beds

operating at an average of 59 percent of capacity. This average capacity can increase to over 80 percent during peak season months (i.e., October - May). Services provided include a 24-hour emergency room, in- and out-patient surgery, and an intensive care unit.

A Master Plan for the entire facility is now in the development and planning stages. The goal of this plan is to expand services as well as relocate units for better patient/work flow. The expansion is projected to begin in fiscal year 1997. Some expansion, such as expanding the Obstetrical Department, has already begun.

Other expansion plans being considered include an Immediate Care/Industrial Medicine Center to be located somewhere in the Coachella/Indio area. No final decision has been made at this time regarding construction and location of this facility.

A non-profit medical clinic, El Progreso del Desierto, Inc., operates two clinics in the City of Coachella. Services provided include medical and dental care. This facility operates on the average at 90 percent capacity. No expansions are being planned in the future.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate health services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan has the potential to increase the population of the Planning Area from 26,291 persons to 153,511 persons, a net increase of 127,220 persons. This population increase would result in additional demand for services at JFK in the future. However, with the expected facility expansion, as well as the proposed Immediate Care Center, hospital officials have indicated that they do not foresee any problems providing medical services to residents of the Planning Area in the future.

El Progreso del Desierto is a non-profit organization that provides medical and dental services to the residents of the eastern Coachella Valley. Build out of the General Plan is not anticipated to have any impacts on the quantity or quality of services provided in the future.

The following General Plan policy reduce impacts caused by implementation of the General Plan to insignificant and no unmitigable impacts are anticipated. General Plan policy encourages the City to provide a diverse range of medical service facilities, including public and private hospitals, medical clinics, emergency care facilities, convalescent hospitals, and specialized private practitioners. General Plan policy provides land use designations throughout the Planning area that allow medical service facilities. General Plan policy designates hospitals and convalescent facilities as sensitive land uses and recommends they be located in areas not subject to excessive noise levels unless the impacts can be mitigated to acceptable levels. General Plan policy requires the City to assist the private sector in developing programs to help frail elderly people and the disabled to receive the types of services that foster independence and integration into the community. General Plan policy requires the City to establish and coordinate community-wide education programs in the areas of substance abuse, sex education and communicable diseases. General Plan policy provides for coordination of efforts to expand free clinic services and loaned personal medical equipment.

Additional Mitigation and Unmitigable Impacts

No significant or unmitigable impacts to medical facilities are expected to occur as a result of General Plan implementation.

3.11.6 Library Facilities

Existing Conditions

Library facilities in the project area are provided by the Riverside City and County Public Library (RCCPL) branch located at 1538 Seventh Street in the City of Coachella. Branch facilities include a 3,000 square-foot building housing approximately 28,300 items. Bookmobile services are provided to the Coachella Valley, including the Planning Area, by RCCPL's regional headquarters located in Indio. For the Fiscal Year ending in June 1995, the library system was funded primarily through a share of County property taxes with some state funding, library fines and fees, as well as gifts and grants. The annual RCCPL budget for the past Fiscal Year was approximately \$14,000,000 ending with a surplus of approximately \$109,000. The City of Coachella does not directly fund or have any administrative relationship with the County library system. However, all branches of the library system are supported by volunteer non-profit "Friends of the Library" organizations. Dues, used book sales, rental books and videos, and the sale of novelty items are the primary fund raising activities. Funds raised are used to support library programs and to supplement library resources.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate library services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan has the potential to increase the City's population by up to 127,220 residents, and will therefore create additional demands on the library system. RCCPL's goal is to add 1.2 volumes and 0.5 square feet for each new permanent resident. This would mean that an additional 152,664 volumes and 63,610 square feet would be required to provide adequate service to all residents in the Planning Area at buildout. The City currently is below standard on space but exceeds standard in volumes and other library material. The Coachella Valley Bookmobile currently serves 55,000 people within the greater Coachella Valley.² Implementation of the General Plan may make it necessary to expand bookmobile services in growing areas of the City.

Funding for these facilities, as stated above, includes a percentage of property tax revenues, state funding, library fines and fees, grants, and donations in the way of gifts. The increase in residential housing within the Planning Area will provide additional revenue available from property taxes and create a larger population base for acquisition of State funds. General Plan Policies provide goals to achieve levels of service that meet or exceed minimum standards, including providing books and facilities for all City residents. Therefore, impacts on the library system as a result of General Plan implementation are considered insignificant.

Additional Mitigation and Unmitigable Impacts

No significant or unmitigable impacts to library facilities are expected to occur as a result of General Plan implementation.

² City of Indio Draft General Plan - 2020, July, 1993.

3.11.7 Public Transportation

Existing Conditions

SunLine Transit provides bus service within the Planning Area and throughout the Coachella Valley. Three lines currently serve the City of Coachella and immediate surroundings. These include:

- ▶ **Line 80**; serving Indio and the northwestern portion of Coachella, runs Monday through Sunday every 50 minutes from 4:40 a.m. to 9:12 p.m.,
- ▶ **Line 90**; serving Coachella from Highway 111 in Indio, south to Avenue 52 in Coachella. This route runs Monday through Sunday every 50 minutes from 4:40 a.m. to 9:13 p.m., and
- ▶ **Line 91**; serving Indio, Coachella, Thermal, and Mecca. This route has four trips a day Monday through Saturday and three on Sunday.

Funding for SunLine Transit comes from a variety of sources including sales tax revenue from the Transportation Development Act, passenger fares, advertising on buses and bus shelters, and Federal funding through the Federal Transit Administration. Present funding does not allow for any additional routes within the Study Area in the near future.

Thresholds of Significance

Impacts would be considered significant if, at general plan buildout, adequate public transportation services could not be provided to serve projected development.

Project Impacts and Mitigation Provided by General Plan Policy

Implementation of the General Plan has the potential to increase the City's population by up to 127,220 residents, and will therefore create additional demands on the transit system. Buildout will occur on an incremental basis, therefore implementation of the General Plan will not create an immediate impact. The added passengers created by the population increase associated with General Plan buildout will partially fund additional transit facilities and services through increased sales tax revenue and user fees.

General Plan policies provide for reducing impacts created from increased demand by requiring developers to construct bus turnouts and bus stops complete with benches, sun and wind protection, telephones, trash receptacles and schedule information at one-quarter-mile intervals on arterial and collector streets, including pedestrian access through noise barriers or other community wall enclosures.

Other significant but mitigable impacts associated with general plan implementation include those related to service areas and accessibility to the handicapped. General Plan policy encourages the establishment of transit stops adjacent to medical facilities, senior citizen facilities, parks, and major shopping and employment areas.

General Plan policy requires the City to coordinate with SunLine Transit to attain a balance of transportation opportunities within the Planning Area. General Plan policy requires the City to coordinate with SunLine Transit and CVAG to identify potential park and ride facility locations to encourage increase transit and ridesharing by City residents. General Plan policy requires the integration of project/neighborhood level path systems with the city-wide circulation system to provide pathways connecting area residents to transit facilities. The above policies will bring to a level of insignificance impacts related to General Plan implementation.

Additional Mitigation and Unmitigable Impacts

No significant or unmitigable impacts to public transit facilities are expected to occur as a result of General Plan implementation.

3.12 Mineral Resources

The following text is a summary of the *City of Coachella General Plan Update 2020 Existing and Potential Mineral Resources* report prepared for this project by Steven C. Suitt and Associates. The complete report, including its appendices appear as Appendix C in the Technical Appendices to this EIR, bound separately.

Existing Conditions

Existing or potential mineral resources in the Coachella General Plan Area include sand and gravel, clay, oil and gas, and geothermal. Portions of the Mecca Hills and associated southwest trending tributaries or canyons contain sedimentary or alluvial deposits composed of sand and gravel construction aggregate resources used for making concrete, asphalt, road base and subbase material, masonry and golf course sand, and other concrete products. Clay is present as "brick-red" fault gouge within the San Andreas fault zone portion of the Mecca Hills. Also associated with the San Andreas fault zone and general vicinity are geothermal resources and oil and gas resources. There is a moderate potential for low-temperature (less than 90 degrees Celsius) geothermal resources and a low potential for oil and gas resources in the planning area.

The Coachella General Plan Area is part of the Palm Springs Production-Consumption area for construction aggregates and other mineral resources as shown on Figure 3.12-1, Palm Springs Production-Consumption Region. The California Department of Conservation, Division of Mines and Geology (CDMG) has estimated that the quantity of construction aggregate resources¹ that occur in the Palm Springs Production-Consumption area is about 3.2 billion tons, of which only 67 million tons were available as reserves² as of 1988. The Coachella General Plan Area contributes about 2%, or 61 million tons of the total quantified sand and gravel resources in this production-consumption area. Based on CDMG aggregate consumption forecasts through the year 2035, the Production-Consumption Region sand and gravel needs for the area has been estimated to be 156 million tons. Considering the status of available reserves in this Production-Consumption area as of 1988, quantified mineral resources would be depleted by the year 2012, unless additional resources are identified and reserves are permitted.

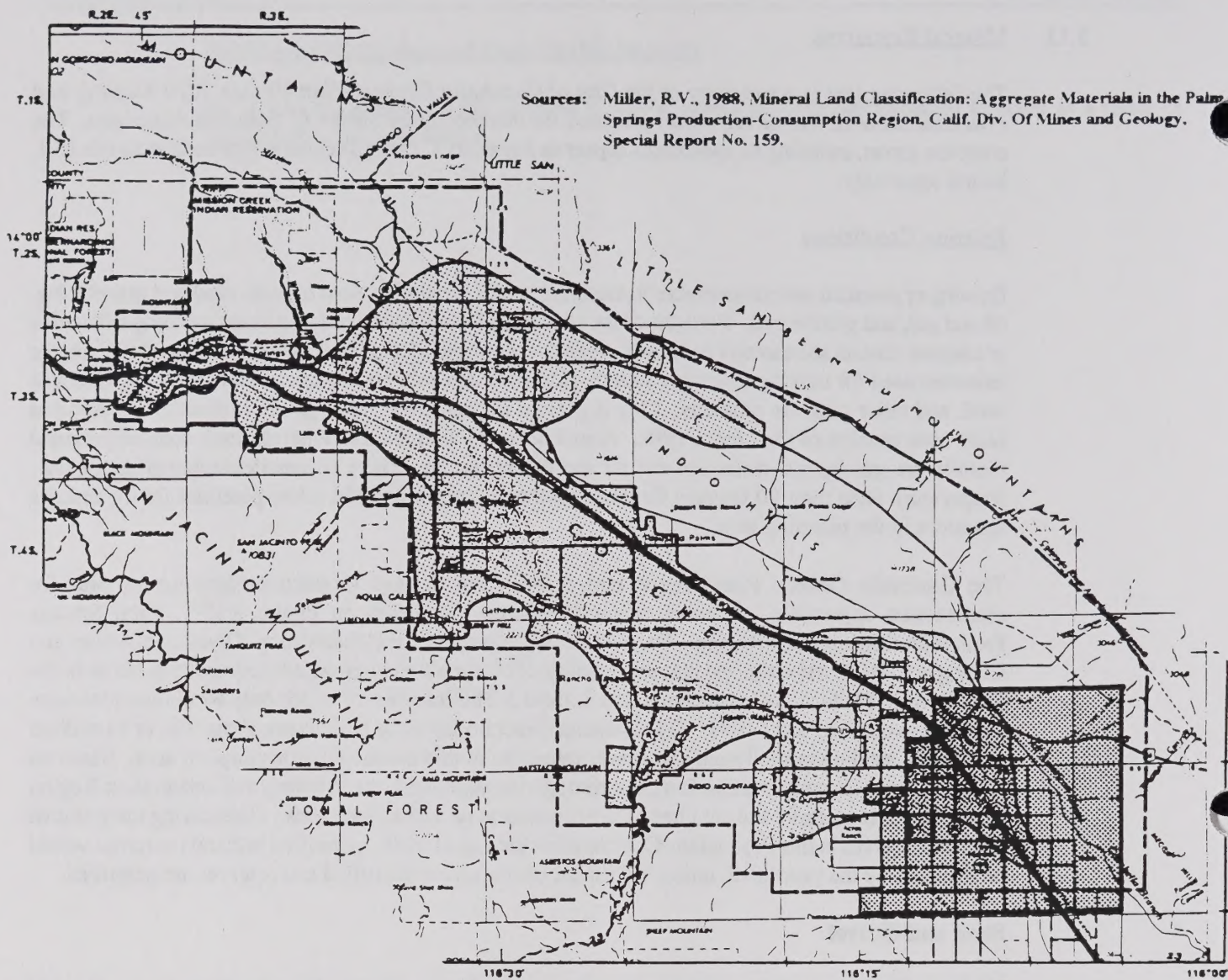
Sand and Gravel

High quality construction aggregates have been actively mined in the Mecca Hills area since the mid 1970's. The CDMG designated these areas as mineral resource zones within the Palm Springs Production-Consumption Region in recognition of the significance of these mineral deposits. In 1975, the Surface Mining and Reclamation Act (SMARA) was passed in order to resolve conflicts between mining (associated with the preemption of prime sand and gravel deposits) and other uses throughout California. This Act requires all cities and counties to incorporate in their General Plans the mapped mineral resource designations approved by the State Mining and Geology Board. There are at least three designations used by the State Geologist to classify mineral lands. These designations, or Mineral Resource Zones (MRZ's), are generally classified based on the suitability of sand and gravel deposits for use as Portland Cement Concrete (PCC) aggregate, and other geological factors. By statute, existing land use is not considered. The three mineral resource classifications commonly used by the State Geologist that are found in the Coachella Planning Area are as follows:

MRZ-1 includes areas where adequate information indicates that no significant aggregate deposits are present or where it is judged that little likelihood exists for their presence.

¹ Resources include all quantified MRZ-2 designated sand, gravel, and other minerals in the Production-Consumption area. Resource quantity estimates may be increased as new data supports the reclassification of MRZ-3 to MRZ-2 lands.

² Reserves are all mineral resources available for, or permitted for mining operations.

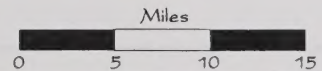


Explanation

-  Palm Springs Production-Consumption Region
-  Areas Identified by OPR to be Urbanized or Potentially Urbanized by 1990
-  Coachella General Plan Area



Source:
Steven C. Suitt and Associates



Palm Springs Production-Consumption Region

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Figure No. 3.12-1

- MRZ-2** indicates adequate information exists to prove that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists. These deposits must be marketable under present technologic and economic conditions or which can be estimated to exist in the foreseeable future, and that contain in excess of \$5 million worth of aggregate material measured in 1978 dollars.
- MRZ-3** incorporates land containing aggregate mineral deposits, the significance (i.e., quantity, quality, and marketability) of which cannot be evaluated from available data.

Figure 3.12-2, CDMG Mineral Land Classification and BLM Mineral Resource Potential Map shows the MRZ classifications within the Coachella Planning Area. MRZ-2 represents the most important classification because it signifies a valuable mineral resource. To further evaluate MRZ-2 areas, the CDMG has subdivided the MRZ-2 classification into sector designations. This assists with defining the quantities of available high quality mineral resources. Sectorization is important because it provides a semi-quantifiable estimate of construction aggregate resources which are likely to be available to satisfy society's needs for the next 50± years. Additionally, areas within MRZ-2 classifications are sectorized if they have current land uses which are similar to those areas that have had feasible mineral extraction in the past. According to the CDMG, MRZ and sector designations have not been amended since 1987.

Those portions of the Coachella Planning Area that have been classified as a MRZ-2 with resource sector designations are shown on Figure 3.12-3, Significant Construction Aggregate Resource Areas in the Palm Springs Production-Consumption Region, BLM Administered Lands Mining Claims, and Other Pre-Permitted Aggregate Production Areas. These sectors, located primarily in the southeastern General Plan Area indicate the existence of mineral deposits that meet certain criteria for value and marketability as defined by the CDMG and SMARA. The City of Coachella is required by SMARA to adopt policies recognizing the importance of all CDMG identified mineral resources (MRZ-2), clarifying the intent for which this information is to be used when making land use decisions in areas designated to be of statewide or regional significance, and emphasizing the conservation and development of the sectorized mineral deposits.

Currently, four existing or potential aggregate production sites or plants are located in the Coachella Planning Area. These include Valley Rock and Sand, Inc., which has been actively mining construction aggregate since 1976; the County of Riverside and CalTrans have been mining sand and gravel from borrow areas in the Mecca Hills since about 1990 for utilization as road base and asphaltic aggregate; and Channel and Basin Reclamation, Inc. has applied for mining permits with the County of Riverside to produce construction aggregates on a 320 acre project site, of which 47 acres will be actively mined. Figure 3.12-3, shows the location of these mining operations. A comparison of Figure 3.12-2 and Figure 3.12-3, shows that mining operations currently being conducted by the County of Riverside and Caltrans, as well as proposed by Channel and Basin Reclamation, Inc., are within areas designated as MRZ-3 by the CDMG. It is anticipated that the area proposed for mining by Channel and Basin Reclamation, Inc. will be reclassified to MRZ-2 in the near future. In addition, Channel and Basin Reclamation, Inc. has identified Upper Palm Springs Formation (Qpu) (see Figure 3.2-1, Generalized Geologic Map, in Section 3.2, Geology) as a valuable resource, therefore Qpu deposits outside the designated MRZ-2 areas within the General Plan Area could be inferred to have a high potential to be converted to MRZ-2 in the future.

Clay

Clay mining has been recorded in the Mecca Hills portion on the General Plan area since 1972. However, actual mine development or production activity has been minimal. Although classified as MRZ-1 by the CDMG, the BLM has identified mining claims in the easterly portion of the Planning Area as having a high potential for the occurrence of clay deposits. However, these BLM mining claims are partially located within the Mecca Hills Wilderness Area and are currently inactive. Privately held lands within the fault zone adjacent to these claims are being considered for a clay mining permit

application. Historic mining activity in the General Plan area includes the Red Top Mine, which was mined for clay prior to 1988, and the Skeleton Canyon Mine, located south of the project site, in which clay resources in excess of five million tons have been identified. Clay mining is not presently occurring within the General Plan Area.

Oil and Gas

Oil and gas exploration in the Mecca Hills and vicinity has occurred sporadically since 1921 and as recently as 1983, but has not produced positive results. However, according to the U. S. Geological Survey (USGS) and Bureau of Mines (BOM), the area southwest of the San Andreas fault has a low potential for oil and gas resources. Leases for oil and gas covered a majority of BLM lands within the Mecca Hills portion of the General Plan area in 1980. One drill hole was completed south of the General Plan area to a depth of 3,792 feet and reported signs of gas and heavy oil. However, there has been no known work since then to confirm the results of this report.

Geothermal

The entire General Plan Area lies within a region identified as favorable for the discovery at shallow depth of thermal water of sufficient temperature for direct heat applications. Two geothermal wells have been drilled within close proximity to the General Plan area that have produced hot water greater than 32 degrees Celsius. Currently, low temperature geothermal wells are being used for aquaculture, direct heat, or agricultural uses in the community of Mecca, south of the Planning Area. The heat source for these geothermal fluids is believed to be associated with a magmatic body at depth beneath the earth's surface that helps heat fluids circulating along fault zones, such as the San Andreas fault. The potential for low-temperature (less than 90 degrees Celsius) geothermal resources is moderate within the General Plan Area.

Thresholds of Significance

Mineral resource impacts would be considered significant if General Plan land use designations precluded Coachella from meeting its fair share contribution to regional aggregate resource production levels as identified by the California Division of Mines and Geology or if mining operations adversely affected adjacent sensitive land uses.

Project Impacts and Mitigation Provided by General Plan Policy

Impacts from the loss of mineral resources are primarily economic. The CDMG has termed the loss of mineral resources as a significant geologic hazard worth several billion dollars. Because construction aggregates and other minerals are considered a non-renewable resource, the City of Coachella is required by State law to adopt policies recognizing the importance of construction aggregates and other mineral resources and reserves. The City is also responsible for designating Regionally Significant Construction Aggregate Resource Areas or identifying mineral resources to be conserved. State law also requires cities to designate such mineral deposits on their General Plan, and to avoid developing incompatible uses on or near them. Two types of impacts must be considered: adverse effects of urban development on future availability and transport of the resource; and adverse effects on urban development of potential increased mining, processing, and transporting of construction aggregates. A summary Planning Area checklist that presents the relative degree of concern for loss of mineral resources or impacts from mineral development is depicted in Table 3.12-1.



CDMG Mineral Land Classification & BLM Mineral Resource Potential Map

CDMG Mineral Land Classification Palm Springs Production-Consumption Region Aggregate Resources

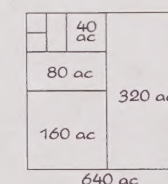
Explanation

- MRZ-1** Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.
- MRZ-2** Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists.
- MRZ-3** Areas containing mineral deposits the significance of which cannot be evaluated from available data.
- Mineral Resource Zone (MRZ) Contact

BLM Mineral Resource Potential

Explanation

- High potential for the occurrence of Sand and Gravel deposits.
- High potential for the occurrence of Clay deposits.
- Moderate potential for the occurrence of Geothermal Resources.
- Boundary of Mecca Hills Desert Conservation Area - 343.
- Northern boundary of Known or Inferred Geothermal Resources (Thermal Waters for Direct heat or Aquaculture)



Source:
Steven C. Suitt and Associates

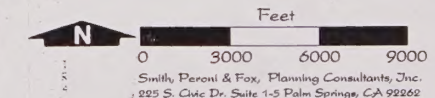


Figure No.3.12-2



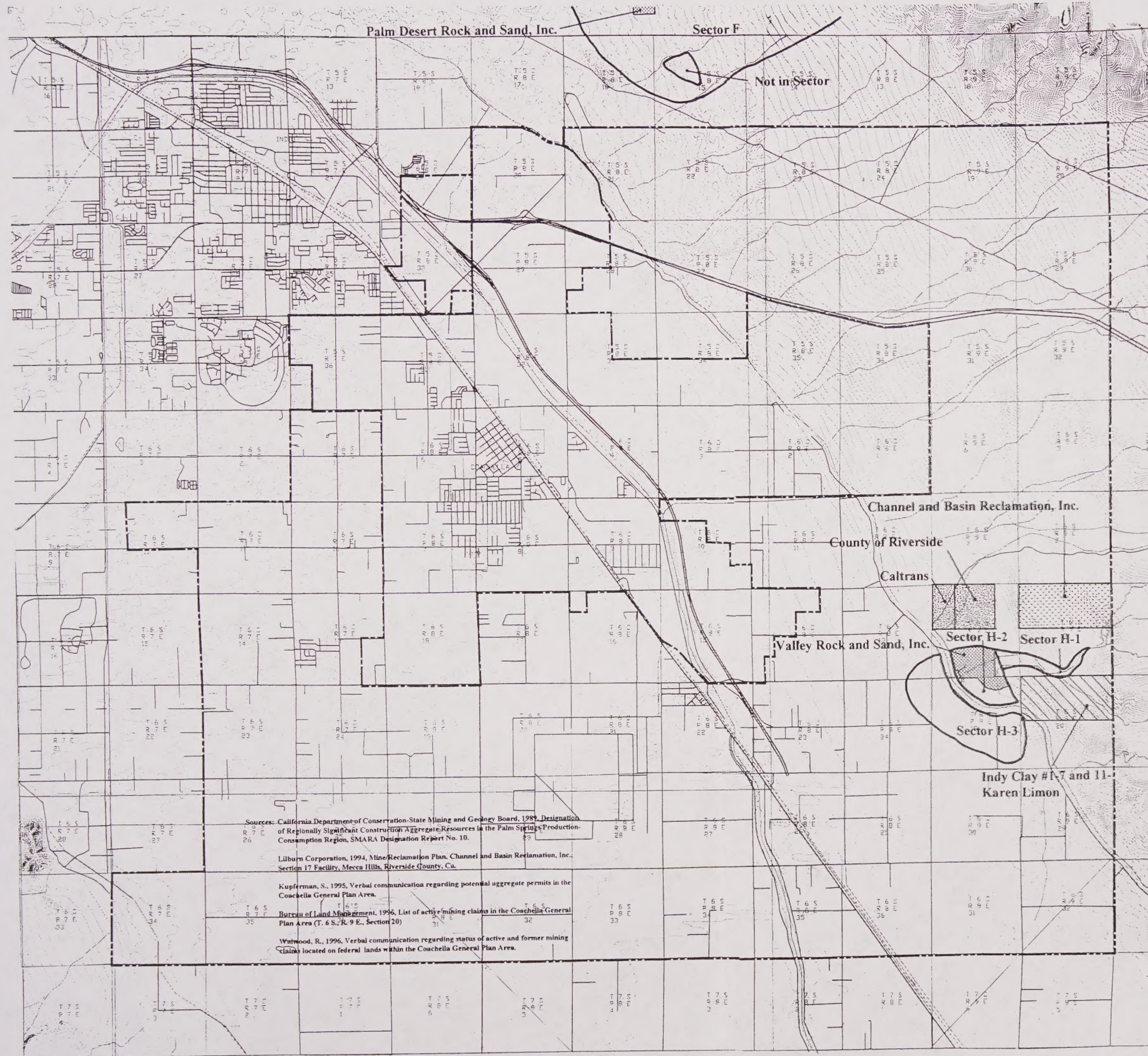
1. The entire Coachella General Plan Area has been classified by the U.S. Geological Survey (USGS) as a Potential Geothermal Resource Area (PGRA) in 1978.

2. The shaded area on the map reflects the Bureau of Land Management (BLM) Mecca Hills Wilderness Study Area (WSA). The Mecca Hills WSA is within the BLM Coachella Geology-Energy-Minerals (GEM) Resource Area (GRA). The entire Mecca Hills GRA had a moderate potential for the occurrence of oil and gas resources based on leases held in the study area in 1980. Other BLM lands north of the Mecca Hills WSA have not been classified for mineral potential to date.

3. The BLM mineral potential designation within the Mecca Hills WSA conflicts with the California Division of Mines and Geology (CDMG) MRZ-1 classification. BLM mining claim recordation and operating permit records indicate that a CDMG MRZ-1 (no significant mineral deposits) area has a high potential for both sand and gravel and clay deposits. Based on the 1990 BLM records, the CDMG would probably re-designate this conflict area as MRZ-2.

Sources:

- Bureau of Land Management (BLM), 1990, California Statewide Wilderness Study Report, Part 4, Volume 6, Containing the Mecca Hills CDCS-343.
- Miller, R.V., 1988, Mineral Land Classification: Aggregate Materials in the Palm Springs Production-Consumption Region, California Division of Mines and Geology Special Report No. 159.



Sources: California Department of Conservation-State Mining and Geology Board, 1989, Designation of Regionally Significant Construction Aggregate Resources in the Palm Springs Production-Consumption Region, SMARA Designation Report No. 10.

Lilburn Corporation, 1994, Mine/Reclamation Plan, Channel and Basin Reclamation, Inc., Section 17 Facility, Mecca Hills, Riverside County, Ca.

Kupferman, S., 1995, Verbal communication regarding potential aggregate permits in the Coachella General Plan Area.

Bureau of Land Management, 1996, List of active mining claims in the Coachella General Plan Area (T. 6 S., R. 9 E., Section 20)

Whitwood, R., 1996, Verbal communication regarding status of active and former mining claims located on federal lands within the Coachella General Plan Area.

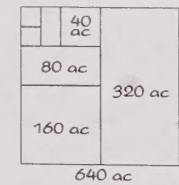


Significant Construction Aggregate Resource Areas

Explanation

- Sector Boundary (CDMG MRZ-2)
- Properties owned, controlled or permitted via regulatory agency by aggregate producers
- Property proposed for mining by aggregate producers, but not yet permitted by regulatory agency
- Property being mined by regulatory agency
- Active Federal administered lands mining claim

Notes: The shaded areas on this map represent existing and potential near-future construction aggregate operations. The current status of mining claims situated on BLM lands may change due to new, 1996 assessment year information and the adjacent Mecca Hills Wilderness issues.



Source: Steven C. Swift and Associates

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Figure No.3.12-3



**City of Coachella Mineral Resources Evaluation - Table 3.12-1
Summary Checklist of Mineral Resource Environmental Concerns***

CATEGORY	POTENTIAL HAZARD/CONCERN	NONE TO SLIGHT	Relative Degree of Concern			COMMENTS
			LOW	MODERATE	HIGH	
Loss of Mineral Resources	*Loss of Access *Deposits Covered by Changed Land-Use conditions *Zoning Restrictions		*	*	*	Minimal roads

*Compared to other areas of southern California as modified from CDMG Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports.

Impacts from construction of surface developments overlying mineral reserves and/or resources or land-use restrictions that prohibit their development would constitute a loss of valuable mineral resources. The General Plan Land Use Policy Diagram preserves the majority of MRZ-2 lands as either agriculture or open space, both of which do not preclude mining activities. A small amount of MRZ-2 land (approximately 25 acres) is designated as Very Low Density Residential which permits mining. This MRZ-2 area is presently being mined by Valley Rock and Sand and therefore the residential land use designation will not preclude mining but rather would take effect after mining has concluded. In addition, approximately 9.5 square miles (6,080 acres) are designated as open space within the Mecca Hills and along the San Andreas fault zone. Within this 9.5 square miles, approximately 191 acres of Qpu deposits exist. As mentioned earlier, Qpu deposits have been identified to be a valuable mineral resource for PCC by Channel and Basin Reclamation, Inc. (CBR). In addition to the deposit proposed for mining by CBR, other similar Qpu deposits occur within the MRZ-3 zone located in the Mecca Hills (in Sections 5, 6, 7 and 8 of Township 6 south, Range 9 east) which represent a potential additional mineral reserve. Consequently, designation of these potential resources within the Open Space land use designation will increase the availability of sufficient mineral resources within the Coachella planning area. Therefore, the General Plan contains sufficient measures for retaining existing and protecting new aggregate reserves sufficient to supply a commensurate portion of the Palm Springs Production-Consumption Region for the next 50 to 100 years. Therefore, no impacts due to loss of mineral resources is anticipated to occur due to implementation of the General Plan.

Table 3.12-2 shows the total number of acres designated as resource and reserve areas within the MRZ-2 zone as well as other potential MRZ-2 lands, the acreage which is being preserved, and those which are affected by urban land uses as designated on the proposed General Plan. As noted, 80% of reserve areas, 97% of resource areas, and 61% of potential MRZ-2 lands are being preserved.

Table 3.12-2, Land Use Impacts on Significant Construction Aggregate Resource Areas

	Total Acres in Planning Area	Total Preserved		Total Impacted by Urban Uses	
		Acres	%	Acres	%
Sectorized MRZ-2 Zone* (Resources)	722	697	97%	25	3%
Reserve Area**	122	97	80%	25	20%
Demonstrated Potential MRZ-2 Zone (Channel and Basin Reclamation, Inc.)	320	320	100%	0	0%
Other Potential MRZ-2 Zone (Qpu deposits)***	315	191	61%	124	39%

* Areas where CDMG has sufficient information on the quality, quantity, and marketability of mineral resources for designation as a regionally significant resource.

** Areas within the MRZ-2 Zone where mining is permitted (i.e., mining permit, zoning designation, etc.) by the lead agency having jurisdiction over such land.

*** Areas with Portland Cement quality aggregates.

Land-use decisions that affect mining access or transportation routes would have an adverse impact on mineral resources. General Plan policy requires the City to clearly identify mineral resource areas, including those areas targeted for conversion to reserves for possible future extraction, in relation to area wide aggregate transportation routes. These transportation routes shall not provide major access to residential or other incompatible commercial uses. Therefore, no impacts to transportation routes will occur due to implementation of the General Plan.

Mining, processing and production activities, including noise, dust and heavy truck traffic, within existing and potential mineral sites can impact adjacent residential, commercial, and vacant properties. Portions of the General Plan Area which have been identified as having mineral potential consist of public (BLM administered) and sparsely populated private land in the Mecca Hills. Proper land use planning and mitigation as outlined in the SMARA guidelines, including reclamation plans, financial assurance bonds, and discretionary review of each mining permit application, can reduce potential impacts to insignificant. In addition, a minimum buffer zone of one quarter mile separating mining activities and incompatible land uses (e.g., residential) would reduce the amount of conflict between these uses to insignificant. General Plan policy provides zoning regulations that allow aggregate extraction as a conditional use in areas identified as mineral resource areas and prohibit incompatible land uses in Regionally Significant Construction Aggregate Resource Areas that are to be conserved. Zoning should cover sufficient area for a 50 year supply of construction aggregate reserve and be reevaluated every 10 years per CDMG Guidelines. Furthermore, General Plan policy provides for the management of aggregate resources to ensure that extraction results in the fewest environmental impacts as well as preparation and assured implementation of a reclamation plan for aggregate extraction sites as a condition of approval of mining. Therefore, no impacts on mineral resources due to incompatible land uses will occur due to implementation of the General Plan.

Clay, oil and gas and/or geothermal resources are generally associated with the presence of the San Andreas fault zone within the General Plan Area. Those minerals in the northeastern General Plan Area identified within close proximity to the San Andreas fault zone would be impacted by land-use decisions in a similar manner as construction aggregate resources. General Plan policy requires sufficient MRZ-3 classification areas be conserved, where appropriate, in the northeastern General Plan Area to assist with supplying the regional demand for the next 100 years, primarily along the San Andreas fault zone where there is also a high to moderate potential for the occurrence of clay and geothermal resources. Therefore, no impacts to clay, oil or geothermal resources will occur due to implementation of the General Plan.

Significant Unavoidable Adverse Impacts

Because the General Plan takes adequate steps to protect mineral resources and provides adequate local contribution to future regional needs, no additional mitigation measures are necessary. In addition, no unmitigable impacts are anticipated as a result of General Plan implementation.

4.0 Required CEQA Topics

4.0 REQUIRED CEQA TOPICS

4.1 Cumulative Impacts

CEQA Section 15130 requires an analysis of cumulative effects found to be significant that includes a summary of projections contained in related planning documents; a summary of expected environmental effects; an analysis of cumulative impacts of related projects using the growth projected and an examination of options for mitigating or avoiding cumulative impacts. Since the project being considered is a General Plan and not a specific development project, the analysis contained in this EIR is, to some degree, cumulative by nature. It should also be noted that the timing of project buildout is not likely to occur until quite some time in the future.

The amount of development considered in a cumulative analysis depends on the resource being evaluated. If the resource is confined to the Coachella Valley (e.g. public transportation) the cumulative impact analysis utilizes projections of growth from the Coachella Valley Association of Governments (CVAG). These projections are contained in CVAG's Regional Housing Needs Analysis (April 1989) prepared by Community Systems Associates. If a resource area includes the whole of Southern California (as in the case of air quality), growth projections from the Southern California Association of Governments (SCAG) Regional Comprehensive Plan (January 1995) are utilized.

In other instances, the area considered for cumulative analysis is the service area of a service provider (e.g. Southern California Edison, the Coachella Valley Unified School District). In these cases, data furnished by the service provider are utilized in the cumulative analysis.

In some cases, the identified cumulative impacts are considered unmitigable even if the affected jurisdictions were to apply all the mitigation that is currently practical and feasible. These unavoidable cumulative impacts occur in the following areas:

- ▶ **Biotic Resources** (regional and cumulative impact issue): Although the City of Coachella will incorporate mitigation measures to conserve biotic resources on a local level, Coachella's incremental contribution to disturbance of habitat on a cumulative/regional level is considered significant.
- ▶ **Air Quality** (regional and cumulative impact issue): Although the City of Coachella will incorporate air quality measures established by the South Coast Air Quality Management District in the General Plan to mitigate impacts on a local level, continued exceedance of state and federal air quality standards will occur on a regional level.
- ▶ **Water Supply** (regional and cumulative impact issue): Although implementation will reduce the amount of water intensive agricultural land through urbanization, the project will result in a net increase in water consumption of 12 MGD. Since groundwater aquifers are considered to be in a state of overdraft, this increase is considered a significant unavoidable adverse impact.
- ▶ **Energy**: (local and cumulative impact issue.) Although feasible energy saving policies are incorporated into the General Plan, implementation of the project will result in a substantial increase in demand for natural gas and electricity and therefore a significant unavoidable impact on non-renewable energy resources.

The following discussion summarizes the cumulative impacts for each of the topical issues discussed throughout this EIR.

Land Use

Land uses proposed in Coachella and surrounding cities including Indio and La Quinta, will contribute to cumulative population growth in the Coachella Valley. Regional impacts in areas such as jobs/housing balance, traffic, noise and air quality (for example) are the cumulative result of land use decisions made by other jurisdictions in the Valley. The City may strive to achieve balance in its own General Plan, but these efforts may be compromised by other Cities' decisions which result in Valley-wide excesses or deficits in certain types of land uses or poor spatial arrangement of uses. These cumulative impacts are mitigable if all the jurisdictions in the Valley remain aware of each other's planning efforts and seek to achieve regional as well as local balance. To this end, the City of Coachella, sponsored by the participates with other local jurisdictions in regional planning programs, Coachella Valley Association of Governments (CVAG) and Southern California Association of Governments (SCAG) programs to provide a regional perspective on land use decisions within the General Plan Area.

Geotechnical

Because the project is located within the seismically active Southern California region, development of the planning area together with other development projected for the sub-region will expose an additional number of people to differing levels of potential geologic and soils hazards. These may include intensive grading of slopes; settlement and collapse of soils; corrosion from soils; landslides/mudflows; wind and water erosion; flooding; leakage from on-site sewage disposal systems and waste disposal facilities due to seismic activity; fault movement; and ground rupture and shaking. This project will also contribute to the potential cumulative loss of mineral resources. These impacts are mitigable if all involved jurisdictions implement measures to mitigate geologic hazards and preserve adequate quantities of mineral resources to meet regional production quotas as identified by the California Division of Mines and Geology.

Hydrology

Buildout of the Planning Area, and of other jurisdictions in the Coachella Valley sub-region, will increase impermeable surfaces and thus increase runoff. This increase in runoff will increase the drainage flows which currently exist in flood control facilities of the Riverside County Flood Control District (RCFCD), Coachella Valley Water District (CVWD) and City of Coachella. Local flood control efforts require RCFCD and CVWD review and approval, a mechanism for which is already in operation. As approval by these agencies is required for local jurisdictions to construct flood control improvements, especially those improvements which affect RCFCD and CVMWD facilities, mitigation of potentially significant impacts occurs as part of the design and review process. No significant cumulative impact is expected on existing valley wide flood control facilities as long as the local jurisdictions continue to adhere to RCFCD and CVWD requirements.

Biotic Resources

Development of the Coachella Valley sub-region will cumulatively impact the biological resources of the area. Increased population and an undetermined amount of associated development will result in an incremental loss of habitat and decrease of biological diversity in the sub-region and could result in a loss of plant and animal species including officially listed species and their habitats. The City of Coachella General Plan supports regional programs, such as the Coachella Valley Multi-species Habitat Conservation Plan, targeted at reducing cumulative impacts to sensitive species and their habitats.

Traffic and Circulation

The CVATS model developed by CVAG was utilized for traffic impact analysis of the project. Traffic volumes projected for the project include existing traffic, project-related traffic, and traffic generated outside the planning area which results in a "worst-case" projection for cumulative future conditions. The City of Coachella General Plan uses the most current CVATS model for traffic analysis.

Due to the magnitude of the growth projected for the Coachella Valley, it is unlikely that transportation programs (Transportation Demand Management, Transportation System Management), even if implemented regionally and by each jurisdiction, will be sufficient to reduce all cumulative traffic related impacts below a level of insignificance. Constraints on street widening and construction of new streets, further increase the likelihood that some roadway segments in the sub-region will reach unacceptable levels of service at least during peak periods. Cumulative traffic impacts can be reduced if all jurisdictions comply with the goals and policies in the Regional Mobility Element developed by SCAG.

Air Quality

Implementation of the General Plan would result in generation of additional pollutants from stationary sources (construction activities, electrical and natural gas usage) and mobile sources primarily from increased vehicular travel. Short-term impacts will result from construction activities due to site disturbance and emissions from construction equipment. Implementation of the General Plan will result in 175,297 tons/day of Carbon Monoxide, 18,840 tons/day of Volatile Organic Compounds, 37,487 tons/day of Nitrogen Oxides, 3,425 tons/day of Sulfur, and 6,396 tons/day of Particulate Matter (PM₁₀).

Although the City of Coachella will comply with South Coast Air Quality Management District Rules and Regulations, the possibility for significant short-term and long-term adverse air quality impacts could occur as a direct or indirect result of buildout of the proposed General Plan Update. Project related cumulative air quality impacts, therefore, may also be significant. Any proposed future projects adjacent to the City of Coachella boundary will, in conjunction with this project, exceed the SCAQMD's significant threshold criteria.

It is not currently possible to mitigate these impacts to a level of insignificance. Adherence to the SCAQMD Rules and Regulations and compliance with locally adopted AQMP and PM10 control measures (in the form of General Plan Update text implementation programs) will help reduce the city-wide air pollutant burden. It is important, however, that the growth pressure experienced in the San Bernardino Valley be monitored as a whole, so that attainment of the state and federal ambient air quality standards occurs as projected. For further information on air quality at project buildout, see the Air Quality Technical Study in the Technical Appendix to this document.

Noise

The noise analysis completed by Endo Engineering analyzed the project's noise impacts on a cumulative and local level. Noise levels in the project area will, however, increase in the future regardless of whether the project is implemented or not because of the inevitability of future development outside the project area. Noise levels on 47 of 62 specific roadways will increase at least 3dB or more, resulting in a significant unavoidable adverse impact.

Noise in the sub-region will increase also due to development pressures in the area. If all jurisdictions comply with noise standards developed by State, Federal and Local agencies, noise impacts can be reduced to a level of insignificance. Policies set forth in the General Plan for the City of Coachella will help reduce impacts caused by increased traffic and short term construction activities. For further information on the ultimate noise levels that will exist in the project area at buildout, see the Noise Technical Background Study in the appendix of this environmental impact report.

Visual Resources

The cumulative impacts of potential development of the City must be considered in conjunction with other proposed development within the Cities of La Quinta, Indio, unincorporated Riverside County lands in the lower Coachella Valley, and to some extent, development throughout the entire Coachella Valley.

The impacts of the Planning Area, when taken together with all of the other projects in the sub-region, have the potential to create a significant adverse impact. This results from the potential transformation of a portion of the lower Coachella Valley into urbanized uses. Since visual quality is subject to the interpretation of the observer, the transformation of the lower valley into more intense urban uses may be considered by some to be a significant cumulative impact. However, policies in the City of Coachella General Plan are intended to both enhance the visual quality of the City and mitigate adverse impacts of urban growth through implementation of policies for City design, historic and scenic preservation, hillside development, and agricultural preservation. If other jurisdictions in the sub-region implement policies similar to those of Coachella (design and historic and scenic preservation), impacts to visual quality can be reduced. The adjacent jurisdictions of La Quinta and Indio have adopted similar design policies.

Cultural Resources

Since the presence or absence of archaeological sites for areas that have not been adequately surveyed is unknown, it is difficult if not impossible to provide a quantitative discussion of cumulative negative impacts on archaeological or paleontological resources. However, it can be noted that most of the planning area, including land used for agriculture, is within an area of high probability for the occurrence of cultural resources owing to the perched water table and resulting shallow well depth found in the Coachella area. In addition, the discovery of archeological sites, proper evaluation, and implementation of mitigation measures has a positive environmental impact component which somewhat offsets the negative impacts of site disturbance. This is because there is an increase in the amount of data collected which leads to greater knowledge and understanding of the prehistory and history of the area.

Public Utilities

Water - Cumulatively, population growth of the Coachella Valley will add to the need for infrastructure to provide water. Developers are generally required to contribute toward the cost of this infrastructure which mitigates this potentially significant impact. As long as all jurisdictions continue to follow standard procedures linking development approvals to the provision of fees for infrastructure, impacts to water resources can be reduced to levels of insignificance.

In addition, regional development of residential, commercial and industrial sites will result in an increased demand on the potable water supply. The entire Coachella Valley utilizes an underground aquifer for its water supply needs. Therefore, cooperation between regional communities and the Coachella Valley Water District (CVWD) is required to prevent depletion of this water supply. The CVWD, in conjunction with their well monitoring and replenishment program, operates a recharge area north of Palm Springs utilizing Colorado River water to recharge ground water levels in the Coachella Valley. Because the lower valley is beginning to show signs of groundwater overdraft, similar recharge programs may be implemented here as well. Cumulatively, groundwater supply is considered a significant impact.

Wastewater - As stated earlier, regional growth in the Coachella Valley will add to the need for infrastructure to provide sewer service. Developers are generally required to contribute toward the cost

of this infrastructure which mitigates this potentially significant impact. As long as all jurisdictions continue to follow standard procedures linking development approvals to the provision of fees for infrastructure, impacts to wastewater systems can be reduced to levels of insignificance.

Solid Waste - Development and a growing population will increase the amount of trash generated within the region. In addition, this will shorten the lifespan of existing landfill facilities and necessitate their expansion, development of alternative waste disposal facilities, or the reduction in the amount of waste generated. The California Integrated Waste Management Act of 1989 (formerly AB939) requires local governments to reduce the amount of solid wastes generated in their jurisdictions and disposed of in a landfill or other means by 50% by the year 2000. If all jurisdictions in southern California implement policies in their General Plans to reduce the generation of solid waste, diversion goals can be met and impacts to landfills can be reduced.

Natural Gas - Development of the Planning Area will create an additional demand for natural gas at buildout. In addition, buildout of the Planning Area, along with other development in The Gas Company's service area will create a cumulative increase in the demand for extension of their infrastructure. This increase will not have an adverse impact on The Gas Company's ability to provide services if all involved jurisdictions continue to follow standard procedures linking development approvals to the provision of adequate natural gas infrastructure at developer expense and require the setting aside of appropriate natural gas easements. Cumulative impacts on energy will result in a substantial increase in consumption of nonrenewable energy resources (natural gas and petroleum products used to produce energy).

Electricity - Development of the Planning Area will create an additional demand for electricity at buildout. In addition, buildout of the Planning Area will contribute to a cumulative increase in demand for the extension of infrastructure in Southern California Edison's (SCE) service area. SCE will be able to provide electrical service to development as it occurs, so long as all involved jurisdictions continue to follow standard procedures linking development approvals to the provision of adequate electricity infrastructure at the developers expense and require the setting aside of appropriate electrical easements. Cumulative impacts on energy will result in a substantial increase in consumption of nonrenewable energy resources (natural gas and petroleum products used to produce energy).

Telephone and Cable - Development of the Planning Area will create an additional demand for telephone and cable services at buildout. In addition, buildout of the Planning Area, along with other development in GTE's and Continental Cablevision's service areas will create a cumulative increase in the demand for extension of their infrastructure. Services can be provided as development occurs so long as appropriate notice is given by the project developer and all jurisdictions continue to follow standard procedures linking development approvals to the provision of fees for infrastructure, impacts to telephone and cable services can be reduced to levels of insignificance.

Public Services

Law Enforcement - Population growth in the region due to implementation of the proposed project will likely result in an increase in the regional crime rate. Currently, homicide, forensics, canine, and SWAT team services for the Planning Area are provided by the County of Riverside Sheriff's Department. As population growth continues on a regional level, greater demand will be placed on the Sheriff's services and the need for the Coachella Police Department to provide these services will occur.

Fire and Paramedic - Increased development will result in an increase in the number of structures in the region and, therefore, increase the potential of fire hazard. It will also create an additional demand for paramedic services. Paramedic services are provided by the Riverside County Fire Department and by a private company, Springs Ambulance Service. Additional fire suppression equipment and stations will

be required to adequately respond to the increased number of calls. As development continues and the number of calls increase, stations in one area may need to provide back-up support for stations in another community.

Parks and Recreation - As population in the region continues to grow, the communities within the area will need to make provision of active and passive recreation for people of all age groups and abilities. This includes the need to provide facilities for the physically challenged.

Schools - Development will increase the number of school age children in the region and therefore increase the demand on existing school facilities. The Coachella Valley and Desert Sands Unified School Districts serve the Planning Area and surrounding region. Existing school facilities in the Planning Area are currently operating at or above capacity. Facilities will have to be provided to accommodate the increased numbers of students, from both Coachella and the region as a whole.

Health Facilities - The proposed project will contribute to a cumulative demand on regional health care facilities in the Coachella Valley. However, since area hospitals have the ability to expand to meet demand, and expansion is currently underway at JFK hospital, this impact will be less than significant.

Library Facilities - Buildout of the Planning Area will contribute to a cumulative increase in the demand for library service and facilities in the Coachella Valley. Additional operating and capital improvement funds to meet increased demand on library services in the region will be required.

Public Transportation - The project will contribute to a potentially significant increase in valley-wide demand for bus facilities. Implementation of fees by each city in the Coachella Valley to generate funding for bus service and expansion will be required to reduce cumulative impacts to insignificant.

4.2 Significant Unavoidable Adverse Impacts

Due to the nature and scale of the project, which guides the development of approximately 84 square miles, it is likely to result in some unavoidable adverse impacts. The impacts associated with this project are contained in Section 3.0 of this document. Nearly all of these impacts identified as significant can be eliminated entirely or reduced to a level of insignificance through implementation of General Plan policies. However certain significant environmental impacts remain which cannot be mitigated to a level of insignificance by means that are practicable and feasible with currently known methods. The unavoidable adverse effects of the project are as follows:

- ▶ **Agricultural Land:** Implementation of the General Plan will result in a loss of approximately 9,271 acres, or 39% of agricultural land when compared with existing land uses in the project area. When compared with the existing General Plan, the amount of agricultural land converted to more intense urban uses drops to approximately 6,698 acres.
- ▶ **Biotic Resources** (regional and cumulative impact issue): Although the City of Coachella will incorporate mitigation measures to conserve biotic resources on a local level, Coachella's incremental contribution to disturbance of habitat on a cumulative/regional level is considered significant.
- ▶ **Air Quality** (regional and cumulative impact issue): Although the City of Coachella will incorporate air quality measures established by the South Coast Air Quality Management District in the General Plan to mitigate impacts on a local level, continued exceedance of state and federal air quality standards will occur on a regional level.

- ▶ **Water Supply** (regional and cumulative impact issue): Although implementation will reduce the amount of water intensive agricultural land through urbanization, the project will result in a net increase in water consumption of 12 MGD. Since groundwater aquifers are considered to be in a state of overdraft, this increase is considered a significant unavoidable adverse impact.
- ▶ **Schools:** Despite the policy mitigations contained in the General Plan, without adequate available funding sources there is still the potential that facilities and resources may not be available to serve the school needs of a growing population. Consequently, school impacts are considered a significant, unavoidable adverse impact.
- ▶ **Noise:** General Plan implementation is anticipated to result in a general increase in ambient noise levels within the City greater than 3.0 decibels and in potential exposure of existing residential areas to noise levels greater than 65 CNEL. These are considered to be unmitigable significant adverse impacts of plan implementation.
- ▶ **Energy:** (local and cumulative impact issue.) All feasible energy saving policies into the General Plan. Despite incorporation, implementation of the project will result in a substantial increase in demand for natural gas and electricity and therefore a significant unavoidable impact on non-renewable energy resources.

4.3 Growth Inducing Impacts

The General Plan Update is by definition growth-inducing, since its purpose is to provide long-range planning for the anticipated addition of 127,220 new permanent residents and approximately 59,623,400 square feet of new commercial/industrial uses. The project will induce growth by designating land for future residential and commercial/industrial development and by providing for the orderly extension of public services and utilities to new areas of development.

In describing how growth-inducing impacts are to be treated in an EIR, CEQA Guidelines Section 15126(g) states that "[i]t must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment."

Given that a project's level of impact in such areas as traffic, air quality and community services is related to the density of development permitted, the goal of a balanced General Plan should be to facilitate the amount and kind of growth necessary to achieve a city's social and fiscal goals without promoting excessive growth which will be costly to the city in terms of environmental impacts and providing services.

4.4 Relationship Between Local Short-Term Uses of the Environment and Long-Term Productivity

The study area contains a small urbanized area surrounded by large amounts of agricultural land in the valley and undisturbed natural land in the Mecca Hills. Approval of the proposed General Plan Update will place in effect a guide to future development of the project area. Over the life of the plan, development in relatively small increments will most likely occur, which is consistent with the proposed land use plan.

The proposed plan permits rural types of development at very low densities in hillside areas. The areas proposed for development at urban intensities will provide accommodations and employment for an increased population in the long-term. This will increase the area's long-term productivity in terms of human population growth and economic return.

In the short-term of a few years the project will most likely permit an increment of development mainly around the existing urban core. Associated with the long-term benefits of providing housing and

increased economic return or the short-term benefits associated with development will be long-term impacts typically associated with development. These impacts are discussed in detail by topic in all Sections of this EIR.

Long-term productivity of the environment will be reduced as development occurs if productivity is defined in terms of natural resources. Development will transform much of the agricultural and natural setting into an urban form. The proposed project could potentially result in urban development displacing agricultural lands in some locations, thus reducing the long-term productivity of this resource in the project area. Conversely, the General Plan preserves a substantial amount of agricultural land. Biological communities will be less productive in the future as portions of their habitat and individuals of each species are destroyed and replaced with urban development, although the General Plan Update affords protection to threatened and some sensitive species. Water and energy resources will be consumed and the air will be subject to additional pollutants generated by the project as development occurs. The consumption of natural gas, gasoline, and electricity will be increased thus increasing the use of fossil fuels. The generation of additional solid waste will require land to accommodate it in landfills.

Adoption of the General Plan Update commits the City to long-term results of decisions made on the basis of information available in 1996. The City's existing General Plan is in need of major revisions as it has not been revised for approximately 10 years. The General Plan Update is intended to fulfill the City's mandate to accommodate population growth and guide development. Comprehensive General Plan Policies have been incorporated which reduce project impacts. With the proposed policies the proposed update approval will allow the City to consider incremental development in an environmentally sound fashion.

4.5 Irreversible and Irretrievable Commitment of Resources

Development of the project area will constitute an irreversible and irretrievable commitment of the following non-renewable resources: open land, agricultural land, energy resources (natural gas, coal, oil, fossil fuels), water, construction materials (lumber, gravel, sand, asphalt, metal), minerals, biological resources, and clean air.

The Coachella General Plan Update will allow for the continued significant conversion of large agricultural and vacant spaces in the project area to urban uses (see Section 3.1 for further discussion). The value of the undeveloped portions of the area as open space and agriculture will be effectively lost with new development. There will also be the permanent loss of visual and biological habitat resources because continued development of the City will result in an alteration of existing landforms in order to accommodate development, and will eliminate some native vegetation and wildlife habitat (see Sections 3.4 and 3.8 for further discussion). The potential loss of open space under the proposed plan is at least partially mitigated by the designation of large portions of the project area as permanent open space, agricultural, and very low density residential development.

Buildout under the proposed project will lead to the long-term irreversible commitment of energy resources from non-renewable fossil fuels, coal and oil. These resources will be consumed through the heating and cooling of air and water, use in commercial and manufacturing operations, and by internal combustion for propulsion motor vehicles and will constitute an irretrievable loss once consumed (see Sections 3.10.4 and 3.10.5 for further discussion). The potential consumption of energy resources by development permitted in the project area under the proposed project can be at least partially mitigated by conservation measures identified in this EIR as well as energy production encouraged in wind, solar and cogeneration facilities.

The project will continue to contribute to a cumulative loss of natural water resources in the Coachella Valley, and contribute to additional need to continue the importation of additional water for recharge (see Section 3.10.1). Furthermore, inasmuch as there are not infinite supplies of fresh water available to share among all communities which rely upon imported water, the water crisis in the southwest, particularly in Southern California, would appear to be inevitable. The impact of the proposed project on natural water supplies may be at least partially mitigated through conservation measures identified in this EIR, including use of reclaimed water, use of water conserving devices, and incorporation of drought-tolerant landscaping into project design. The impact of water loss on natural habitat may be at least partially mitigated through controlling development adjacent to surface streams and springs.

The volume of traffic in the project area will increase incrementally with development of the proposed project, resulting in the additional consumption of non-renewable fossil fuels. The increase in Vehicle Miles Traveled in the project area will result from the incremental increase in the population and thus the number of automobiles, buses, and airplanes required to serve the population, and as a result of the increase geographical expanse of urban area. This impact will be at least partially mitigated through implementation of TDM and other trip reduction mechanisms, and by the increase utilization of mass transit as required by mitigation in this EIR (see Sections 3.5 and 3.11.1 in this EIR for further discussion).

Air quality in the project area, and the Coachella Valley, will be degraded as a result of project and cumulative urban growth. Chiefly through automobile generated pollutants and grading activities, the amount of pollutants and particulate levels in the vicinity of the project area will increase, although the major cause of air quality problems will continue to be pollutants carried in from elsewhere in the air basin. Project related impacts on air quality will be at least partially mitigated by state and federal clean air standards, policy in the proposed General Plan with regards to grading, and mitigation in this EIR requiring trip reduction programs and particulate suppression in new development (see Sections 3.5 and 3.6 for further discussion).

The first part of the report deals with the general situation of the country. It is a very interesting and informative study of the country's development. The second part of the report deals with the specific details of the country's development. It is a very detailed and informative study of the country's development.

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5.0 Alternatives to the Proposed Project

5.0 ALTERNATIVES TO THE PROPOSED PROJECT

This evaluation of alternatives to the proposed General Plan update considers those environmental issues which have been evaluated throughout this document and compares the impacts of each alternative. Following the discussion, the various alternatives are presented in a comparative matrix which quantifies the impacts when possible.

This section will not address the issue of alternative locations for the proposed Coachella General Plan update. CEQA requires an evaluation of alternative locations only when it is deemed reasonable and could feasibly attain the basic objectives of the proposed project. In this case, the basic objective is to establish a desired land use pattern for the City of Coachella and the overall planning area. The City of Coachella cannot reasonably acquire or control an alternate location, and the basic project objective cannot be feasibly attained for this project at any other location. Therefore, an alternate location is rejected as infeasible.

5.1 Description of Alternatives

- Alternative 1: Existing General Plans (No Project)
- Alternative 2: Agricultural Preservation - No Entertainment Area
- Alternative 3: Mecca Hills Preservation
- Alternative 4: Reduced Traffic Impacts (25% Reduction in Industrial)
- Alternative 5: Kohl Ranch

Table 5.1-1 below, Statistical Comparison of Alternatives, lists the number of residential dwelling units, commercial and industrial square feet, and total projected population at buildout for each alternative.

Table 5.1-1 Statistical Comparison of Alternatives			
Alternative	Residential (dwelling units)	Non-Residential¹ (bldg. square feet)	Population
Proposed Project	50,497	61,361,700	153,511
Alt. 1	29,608	75,009,500	90,040
Alt. 2	41,476	58,293,615	125,879
Alt. 3	42,671	61,361,700	129,004
Alt. 4	50,525	50,319,335	153,596
Alt. 5 ²	52,697	68,005,675	159,651

¹ Includes Commercial, Industrial, and Public land uses.

² Reflects only the portion of Kohl Ranch within the Planning Area which is estimated to be approximately 2,200 dwelling units and 6.6 million square feet of non-residential uses. The entire Kohl Ranch project includes a total of 7,171 dwelling units and about 9.8 million square feet of non-residential uses.

Alternative #1 - Existing General Plans (No Project)

Section 15126 (d)(4) of the CEQA Guidelines states that the "No Project" alternative must discuss existing conditions, as well as what would reasonably be expected to occur in the foreseeable future under current existing plans. It is not reasonable to assume that no further development would take place in the Planning Area. Therefore, this alternative assumes buildout under the existing City of Coachella General Plan (adopted in 1987) and under the County of Riverside General Plan (adopted in 1989) for unincorporated portions of the Planning Area. The existing General Plans would result in approximately

29,608 dwelling units and about 75,000,000 square feet of commercial and industrial land uses. In comparison with existing conditions, buildout under existing General Plans would result in about an 82% increase in residential units and a 530% increase in non-residential building square footage.

The actual "no development" scenario is described as the "existing conditions" section of each environmental topic (Section 3.0) and is quantified wherever possible. As of March 1996, there were 5,347 dwelling units, 1,738,300 square feet of non-residential buildings and an estimated population of 20,800. While the "no development" alternative would be environmentally superior to the other alternatives, it fails to meet any of the goals and objectives of the existing and proposed general plans and would require placing all undeveloped properties into open space or similar category and thus constitute a "taking" of land. This scenario would not be acceptable, desirable, or legal.

Alternative #2 - Agricultural Preservation - No Entertainment Area

This alternative preserves agriculture within the Very Low Density Residential (RVL) Agricultural to Urban Transition Overlay and the Entertainment Commercial (CE) designations. This would result in the preservation of nearly all agricultural areas within the study area but would reduce the amount of low density residential land and eliminate entirely the proposed Entertainment Area. In comparison with the project, dwelling units and population would be reduced by about 22%, while the non-residential building square footage would be lowered by about 5%. This reduction in population would also result in some reduction of traffic although it probably not enough to significantly improve service levels in the areas (i.e., west of the Coachella Stormwater Channel) where traffic LOS impacts are most pronounced. Vehicular emissions and noise levels related to vehicular traffic would also improve slightly.

Alternative #3 - Mecca Hills Preservation

Assumes preservation of the Mecca Hills by designating all RVL lands east of the All-American Canal under the Riverside County General Plan designation of Desert Areas which allows one dwelling unit per ten acres. This would result in approximately 584 dwelling units as compared with a potential of over 8,000 units under the proposed General Plan. When combined with the BLM lands, this alternative would preserve a substantial portion of the Mecca Hills as open space with the exception of the McNaughton Specific Plan. The majority of the existing undisturbed Desert Scrub Community would remain intact, preserving habitat and foraging areas for sensitive and non-sensitive wildlife species. Portions of the Mecca Hills are within Coachella Valley fringe-toed lizard habitat, Palm Springs ground squirrel habitat, Spotted Bat habitat, and Golden Eagle foraging area. This alternative would also reduce traffic to the I-10 freeway, Avenue 52 and other roadways in the vicinity of the Mecca Hills. None of the geotechnical or aesthetic concerns associated with developing the Mecca Hills would occur under this scenario. However, additional disturbance could occur on BLM controlled lands through mining claims and other public uses, subject to BLM approval.

Alternative #4 - Reduced Traffic Impacts (25% Reduction of Industrial)

Assumes overall reduction of industrial lands within the Study area by 25% and is intended to provide an alternative which will reduce traffic impacts. The proposed project would result in approximately 4,528 acres of industrial land uses. A 25% reduction would result in about 3,396 acres of industrial uses, thus reducing industrial square footage by about eleven million square feet. It is also assumed that the acreage removed would remain in agricultural production, thus allowing an additional 28 dwelling units (at 1 du/40 acres). Since the large amount of industrial land is a significant contributor to future traffic volumes within the city, this would reduce traffic west of the Coachella Valley Stormwater Channel where traffic impacts are greatest. This alternative would also reduce other traffic-generated impacts such as noise along roadways and vehicle emissions.

Alternative #5 - Kohl Ranch

This alternative assumes that the Kohl Ranch Specific Plan project located south of the Thermal Airport is approved by Riverside County. The Specific Plan encompasses 2,177 acres, of which about 1,280 acres are in the Coachella Planning Area. The project includes residential, industrial, commercial, office, warehousing, and airpark/mixed use with the remaining acreage dedicated to open space and public facilities/right-of-ways.

Approval of the Kohl Ranch would include a total of 7,171 dwelling units and about 9.8 million square feet of non-residential uses. Approximately 2,200 dwelling units and 6.4 million square feet of non-residential uses would be within the Planning Area. Therefore, the alternatives analysis directly compares only that portion which lies within the Planning Area and evaluates the balance of the Kohl Ranch as though it were an off-site adjacent land use in Riverside County. For example, indirect impacts such as increased traffic within the study area and associated increases in vehicle emissions and noise are based on the total Kohl Ranch project. Land use, biotic resources and other on-site issues such as loss of agricultural lands are based on the partial project.

5.2 Conclusions and Alternatives Matrix

The following section presents conclusions as to which alternatives are preferred and ranks them compared with the proposed project. The alternatives are first evaluated and ranked on an overall basis using population as a general indicator of impact. Population is used because, in general, the level of impact for most topics is ultimately related to population increase or an increase in nonresidential square footage. The alternatives are next ranked in relation to various specific environmental topics. This topical comparison of alternatives is provided since a given alternative may mitigate one impact very effectively yet be ineffective in mitigating, or even increase, the impact on some other environmental topic. Not all environmental topics have been selected for comparison below. Only those which require mitigation as a significant adverse impact of the project or are perceived as a broad based community issue. For this project, the most important topics have been identified as land use (agricultural retention), biology, air quality, water supply, schools, noise and traffic. All topics are addressed in the Alternatives Matrix, however.

If all the alternatives are ranked using population as a relative indicator of impact, Alternative #1, the no-project alternative is the preferred alternative. This is so since no additional impacts would occur if the project site remains in its present condition, and lesser impacts than either the project or other alternatives would result if it were to be developed under existing General Plan designations which would build out at about 59% of project population. The No-Project No-Development alternative, however, would result in a moratorium on all development which would not be consistent with the City's goals and objectives or be beneficial for the community as a whole. Ranking the remaining on-site alternatives by population increase, Alternative #2 (Agricultural Preservation) is ranked second and would result in 82% of project population, Alternative #3 (Mecca Hills Preservation) is third preferred with 84% of project population, Alternative #4 (Reduced Industrial) is fourth preferred at about the same population as the project and finally Alternative #5, (Kohl Ranch) is fifth preferred at 104% of project population.

For each of the most important environmental topics noted above, the following alternatives were preferred for the reasons given after each topic.

Agricultural Preservation - Alternative #2 provides the greatest amount of agricultural land by preserving the Entertainment Commercial and Very Low Density Residential, Agricultural to Urban Transition Overlay in agricultural production. Alternative #1 also preserves significant amounts of agriculture land since many areas targeted for conversion to urban development under the proposed project are designated as agriculture on the County General Plan.

Biology - Alternative #2 would preserve the largest amount of habitat in the Mecca Hills by retaining the County "Desert" designation which allows only 1 unit per 10 acres of land on privately owned lands and designating public lands as "Open Space". Alternative #3 would also preserve the entire Mecca Hills in the "Desert" designation but is slightly less desirable since it would eliminate the "Open Space" designation on public lands. Other alternatives primarily affect development within the valley area which contains fragmented habitat of lesser value.

Air Quality - Alternative #1 would result in the greatest reduction in residential development while Alternative #2 would result in the greatest reduction in nonresidential building square footage. Consequently, both would have a positive impact on air quality compared to the proposed project.

Water Supply - Alternative #3 would result in the greatest reduction in water consumption by substantially reducing residential development in the Mecca Hills. Alternative #5 would also reduce water consumption, but not as much, since it would convert significant amounts of agriculture land to urban uses. All other alternatives would decrease urbanization and preserve agriculture in varying degrees resulting in increased water consumption when compared with the project.

Schools - Alternative #1 has the lowest population increase and would therefore result in the greatest reduction in overall student generation over the proposed project. Fewer students would create less demand for school facilities and resources.

Noise - Alternative #2 has the lowest daily vehicular trip generation and would therefore result in the lowest over all noise levels as compared to the proposed project.

Traffic - Alternatives #3 and #4 would result in similar reductions in traffic as compared to the proposed project. Of the two most congested corridors, Alternative #3 would result in the greater reduction (2.6%) along the Harrison Street corridor while Alternative #4 would result in the greater reduction (6-10%) along the Tyler Street corridor.

**Table 5.1-2
Comparison of Alternatives**

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Land Use	The project will result in a total of 50,497 dwelling units and approximately 61,361,700 square feet of non-residential structures as compared to 5,347 dwelling units and 1,782,800 square feet in non-residential structures under existing conditions. The General Plan Diagram establishes the land use pattern throughout the planning area and is intended to promote orderly development and to minimize land use conflicts. General Plan policies are anticipated to provide adequate mitigation to potential land use impacts.	Buildout under the existing General Plans would generate 29,608 dwelling units and 75,009,500 square foot of non-residential structures. In comparison with the proposed project, the number of dwelling units would be reduced by about 42% and non-residential square footage would be increased by about 80%.	Would result in the preservation of most agricultural areas within the study area, while eliminating the Entertainment Commercial area and reducing the amount of Very Low Density Residential by about 9,000 units. In comparison with the project, the number of dwelling units would be reduced by about 18% and non-residential square-footage would be reduced by about 5%.	Would result in a reduction of approximately 7,800 dwelling units in the Mecca Hills area when compared with the project, a 16% reduction in units. Non-residential building square footage and all other land uses would remain the same as the project.	Reduces the amount of land designated as Industrial by 25% and reduces building square footage by about 11 million square feet. It is also assumed that the acreage removed from industrial would remain in agricultural production, allowing an additional 28 dwelling units.	Assumes the Kohl Ranch Specific Plan is approved by Riverside County. This would at about 2,200 dwelling units (4%) and about 6.4 million square feet of non-residential uses within the Planning Area. The remainder of the Kohl Ranch project would be considered an adjacent off-site land use (the remainder of the project includes an additional 3.4 million square feet of non-residential buildings and about 5,000 additional dwelling units).

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Geotechnical	Proposed development of the project area will result in potential exposure of additional persons and property to seismic and geotechnical hazards. Seismic hazards include ground rupture, ground shaking, liquefaction, soil expansion, and settlement/compaction. General Plan policies will mitigate most of these hazards with the exception of unanticipated seismic hazards.	Similar to the project, but would expose about 41% fewer people and structures to geotechnic hazards due to lower population and residential units. However, non-residential building square footage would increase by about 18%.	Similar to the project, but would expose 18% fewer people and structures to geotechnic hazards due to slightly lower population and residential units.	Similar to the project, but would expose about 16% fewer residential units and people to geotechnic hazards. Nonresidential building square footage would remain the same as the project.	Similar to the project, but would expose an additional 28 residential units and about 85 more people to geotechnic hazards. Industrial building square footage would be reduced by 25% in comparison with the project.	Similar to the project, but would expose 4% more residential units, 10% more non-residential building square footage and about 4% more people to geotechnic hazards.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Hydrology	Implementation of the General Plan will increase runoff and exacerbate local flooding by increasing the amount of impervious surface area in the project area. However, the City of Coachella is in FEMA Flood Zone C, "Areas of Minimal Flooding" and therefore, implementation of the proposed General Plan would not require flood control improvements. Furthermore, the Coachella Stormwater Channel has the capacity to handle a 100 year flood event, reducing impacts from flood hazard to a level of insignificance.	This scenario would result in similar impacts as the project, but impervious surfaces would increase slightly over the project due to 18% increase in non-residential building square footage.	This scenario would result in similar impacts as the project, but impervious surfaces would be reduced slightly in comparison with the project due to lower number of residential units and building square footage.	This scenario would result in similar impacts as the project, but impervious surfaces would be reduced slightly in comparison with the project due to lower number of residential units. Non-residential building square footage would be the same as the project.	This scenario would result in similar impacts as the project, but impervious surfaces would be reduced slightly in comparison with the project due to lower number of residential units.	This scenario would result in similar impacts as the project, but impervious surfaces would increase slightly over the project due to 10% increase in non-residential building square footage and 4% increase in residential units.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Biotic Resources	Implementation of the proposed General Plan will reduce the amount of habitat available to wildlife and increase disturbance to native flora and fauna due to development of previously undisturbed or agricultural land and increased use of open space by a larger population. Two Federally listed species occur, or have the potential to occur, within the Planning Area. These species include the Coachella Valley Fringe-toed Lizard and the Desert Tortoise. Policies in the General Plan serve to reduce or avoid significant impacts to sensitive species. However, the loss of habitat due to project implementation will contribute to an unmitigable regional loss of habitat.	Under existing General Plans, structural square footage has the potential to increase by about 13,650,000 square feet over project build out while residential development would decrease by about 20,889 units. This would result in less habitat loss due to direct conversion of land to urban uses. The indirect loss of habitat due to human intrusion would also improve in comparison with the project due to the decrease in population of about 41%.	Since agriculture would remain in the Commercial Entertainment and Agriculture to Urban Transition Overlay, it would be available as foraging habitat for some species. Natural vegetation would be preserved in the northern portion of the Entertainment area which is also a known habitat area for the Coachella Valley fringe-toed lizard and the Palm Springs ground squirrel.	The majority of undisturbed vegetation within the Mecca Hills would remain as open space under this scenario, preserving habitat and foraging areas for sensitive and non-sensitive wildlife species.	This scenario would not differ substantially from the project, except that it would preserve slightly more agricultural lands and some native vegetation adjacent to the Coachella Valley Storm Channel.	This scenario would not differ substantially from the project, except that it would result in the conversion of an additional 1,280 acres of agricultural land to urban uses, thus removing that area as foraging habitat.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Traffic and Circulation	The proposed General Plan update would result in 97,004 AM peak hour trips, 151,861 PM peak hour trips and 1,408,720 daily two way trips. The highest area traffic volumes are concentrated along the Harrison/ Grapefruit/Dillon Road corridor and the Tyler/ Grapefruit/ Avenue 52 corridor.	This alternative would result in 90,963 AM peak hour trips, 137,029 PM peak hour trips and 1,208,210 daily two way trips, 16.6% less than the proposed project. Trip distribution would be similar to the proposed project, with reductions primarily in the Entertainment Area and the Mecca Hills.	This alternative would result in 83,570 AM peak trips, 124, 224 PM peak hour trips and 1,109,050 daily two way trips, 27% less than the proposed project. Trip reductions would be centered around the Entertainment Area and east and west of the central Grapefruit Boulevard Industrial corridor.	This alternative would result in 91,221 AM peak hour trips, 143,992 PM peak hour trips and 1,334,370 daily two way trips, 6% less than the proposed project. Traffic decreases would be focussed in the eastern portion of the study area adjacent to the Mecca Hills with a 2.1% decrease on the Harrison Street corridor and 3.3% on the Tyler Street corridor.	This alternative would result in 85,285 AM peak hour trips, 139,406 PM peak hour trips and 1,320,260 daily two way trips, 6.7% less than the proposed project. Traffic decreases would be focussed in the central portion of the study area with a .4% decrease on the Harrison Street corridor and a 6-10% decrease along the Tyler Street corridor.	This alternative would result in 105,716 AM peak hour trips, 164,242 PM peak hour trips and 1,515,640 daily two way trips, 7.6% more than the proposed project. Increases would be focussed in the southern portion of the planning area south of Thermal Airport.
Air Quality	The project area at buildout is estimated to generate 87.6 tons/day of CO; 9.4 tons/day of VOC; 18.7 tons/day NOx; 1.7 tons/day SOx; and 3.2 tons/day PM10. Air quality control measures from the AQMP are incorporated into the General Plan. Despite these measures, General Plan implementation will result in exceedance of air quality standards.	Existing General Plans would generate an estimated 75.2 tons/day of CO; 8.1 tons/day of VOC; 16.3 tons/day of NOx; 1.5 tons/day of SOx; and 2.8 tons/day of PM10.	Would generate an estimated 69.0 tons/day of CO; 7.4 tons/day of VOC; 15.0 tons/day of NOx; 1.4 tons/day of SOx; and 2.5 tons/day of PM10.	Would generate an estimated 83.0 tons/day of CO; 8.9 tons/day of VOC; 17.7 tons/day of NOx; 1.6 tons/day of SOx; and 3.0 tons/day of PM10.	Would generate an estimated 82.1 tons/day of CO; 8.8 tons/day of VOC; 17.4 tons/day of NOx; 1.6 tons/day of SOx; and 3.0 tons/day of PM10.	Would generate an estimated 94.3 tons/day of CO; 10.0 tons/day of VOC; 20.2 tons/day of NOx; 1.8 tons/day of SOx; and 3.4 tons/day of PM10.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Noise	The proposed project would result in significant audible increases in noise levels greater than 3.0 decibels over ambient conditions since the study area is largely undeveloped. In addition, noise impacts would occur to existing residential developments along Harrison Street and Avenue 52. These are considered significant unmitigable impacts.	Alternatives 1, 3, and 4 will generate similar vehicular noise levels on a citywide basis. There may, however, be audible noise differences on individual roadway links based upon the location of specific projects and the distribution of traffic along the circulation network.	Alternative 2 has the lowest daily trip generation (1, 109,050 ADT) of the five General Plan Alternatives, and will thus generate the lowest overall noise levels. With the difference in daily trip generation, a typical roadway link under Alternative 2 will average approximately one decibel less than the same link under the proposed General Plan Update. A one decibel difference is considered the lower limit of a potentially audible noise impact. Localized noise reductions in the Entertainment Area and transition overlay areas would occur.	Alternatives 1, 3, and 4 will generate similar vehicular noise levels on a citywide basis similar to the project. Localized noise reductions would occur in the Mecca Hills area.	Alternatives 1, 3, and 4 will generate similar vehicular noise levels on a citywide basis similar to the project. Localized noise reductions would occur in the Industrial area.	Each of the General Plan Alternatives will generate similar vehicular noise levels on a citywide basis. Alternative 5 has the highest daily trip generation (1,515,640 ADT) of the five General Plan Alternatives, and will thus generate the highest overall noise levels. A typical roadway link under Alternative 5 would generate a noise level approximately 0.3 decibels more than the same link under the proposed General Plan Update. This difference in noise levels would be considered inaudible. Localized noise increases would occur in the Kohl Ranch area.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Visual and Aesthetic Resources	The primary visual impact of the project would be an increase in urban growth and a reduction in agriculture and natural open space. The General Plan contains policies for City design and scenic preservation to address this potential impact and reduce it to a level of insignificance. General Plan policies related to light and glare mitigate impacts to a level on insignificance, with the exception of casinos on Tribal lands, which the City has no jurisdiction over.	Although a development pattern similar to the project would take place under existing plans, there would be lower residential densities and more intense non-residential development. Impacts from light and glare are similar to the project. It is anticipated that this alternative would have greater impacts on visual resources than the project.	This alternative is similar to the project, except that most of the agricultural areas within the study area would be preserved. Therefore, from a visual standpoint, this scenario would have lower impacts than the project since less conversion of agriculture to urban uses would occur.	This alternative would reduce the intensity of urban development in the Mecca Hills and retain their existing natural character almost entirely.	This alternative is similar to the project since the reduction in industrial land would not significantly change the visual character of the study area and the remaining 75% industrial land would still set an intense urban visual environment for that area.	This alternative would impact the visual environment by introducing urban uses south of Thermal Airport where agriculture predominates. Urban uses would also introduce night lighting at this location.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Historic, Archaeologic, and Paleontologic Resources	Approval of the General Plan will encourage development within the Planning Area which could potentially have an adverse impact on areas which have not been surveyed for cultural or paleontological resources. Policies in the General Plan encourage preservation and protection of known resources and artifacts found during the course of development. Policies also serve to identify, maintain, protect and enhance the City's cultural, historic, and architectural resources.	Similar to the project in that development could potentially occur in areas containing cultural resources. Policies in existing General Plans would serve to mitigate impacts on cultural resources.	This alternative would retain existing agricultural uses in certain areas which would maintain the existing level of disturbance to cultural resources. Impacts would not differ substantially from proposed project.	Preservation of the Mecca Hills would provide for complete preservation of any Native American resources such as Indian trails and other artifacts occurring in that area.	This alternative would have no affect on preserving cultural resources in the Planning Area and would not differ substantially from the proposed project.	Development of Kohl Ranch would remove approximately 1,280 acres from agricultural land uses. Impacts would not differ substantially from proposed project.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
PUBLIC SERVICES Water	Implementation of the General Plan will increase the demand on the existing water supply by 12,110,804 gallons per day. Conversion of agricultural uses (more intensive) to urban uses (less intensive) has a balancing effect but would still result in a net increase in water consumption.	Under the existing General Plan, approximately 140,000,000 gallons per day of water is used in the Planning Area, of which 96 percent is used for agriculture.	Would add approximately 8,200 acres of agricultural land uses increasing the total water consumption in the Planning Area by approximately 33,055,510 gallons per day at buildout.	Preservation of the Mecca Hills would reduce the total number of single-family residences in the Planning Area by about 7,800 units, reducing the total water consumption by approximately 6,737,720 gallons per day.	This alternative would reduce the total Industrial land use from 50,983,000 square feet to about 38,238,000 square feet which would reduce the total water consumption in the Planning Area by approximately 11,886,000 gallons per day.	This alternative will convert approximately 1,280 acres in the Coachella Planning Area designated as agriculture into approximately 298 acres commercial, 90 acres industrial and 275 acres residential land uses. The remainder will be left as open space and rights of way. This will reduce total water consumption in the Planning Area by approximately 6,218,525 gallons per day at buildout.
Wastewater	Implementation of the proposed General Plan Update will create an additional demand of 34.6 MGD in the Planning Area for a total wastewater generation 38.1 MGD at buildout. Existing sewerage systems in the Planning Area have a combined ultimate design capacity of 61.1 MGD, therefore, no impact to the existing sewerage system is anticipated in the future due to implementation of the General Plan.	Similar to the project in that no impacts on wastewater facilities will occur under this alternative since residential generation is decreased but industrial generation is increased. Existing wastewater generation in the Planning Area is 3.4 MGD for all uses.	Under this alternative, approximately 8,200 acres of land will be converted to, or preserved as agriculture. This will result in a reduction in wastewater generation of approximately 13.5 MGD in the project area at buildout.	Preservation of the Mecca Hills will reduce the number of single-family residences by over about 7,800 units which will result in a reduction of approximately 4.1 MGD.	Reduction of the Industrial land use by 25 percent will reduce wastewater generated in the Planning Area by 4.4 MGD.	This alternative will convert approximately 1,280 acres in the Coachella Planning Area designated as agriculture into approximately 298 acres commercial, 90 acres industrial and 275 acres residential land uses. The remainder will be left as open space and right of ways land uses. This will increase total wastewater demand in the Planning Area by approximately 1.4 MGD at buildout.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Solid Waste	Additional population and development will result in an increase of solid waste generation. City policies and programs are designed to reduce per capita waste generation and increase recycling.	Existing General Plans would be subject to the same solid waste reduction goals as the project. Decreases in population would result in less waste generation than the proposed project.	Decreases in population and overall development will result in less waste generation than the proposed project. Waste associated with agriculture would be greater than the proposed project.	Decreases in population and overall development will result in less waste generation than the project.	Similar to project but would reduce solid waste generated by industrial uses. Would be subject to the same waste reduction goals as the project.	Since the Kohl Ranch would replace agriculture uses with urban development, solid waste associated with added population would increase while agricultural waste would decrease.
Natural Gas and Electricity	Total electricity consumption at buildout is estimated to be 980,487,455 Kwh per year as compared to existing consumption of 49,969,960 Kwh per year. Natural gas consumption is estimated to be 6,210,754,955 cubic feet per year as compared to existing consumption of 455,935,445 cubic feet per year. Both Southern California Gas and Southern California Edison have indicated that they will be able to meet gas and electrical demands related to the project and will expand facilities as needed.	Buildout under existing General Plans will result in a total electrical consumption of 982,725,635 Kwh per year and total natural gas usage of 4,980,755,325 cubic feet per year. This alternative would create a greater demand for non-renewable energy resources than the project.	Energy consumption would be reduced to approximately 867,097,285 Kwh of electricity per year and 5,260,750,110 cubic feet of natural gas per year.	Energy consumption would be slightly lower than the project under this scenario with an estimated electrical demand of 936,579,415 Kwh per year, and a natural gas demand of 5,585,503,385 cubic feet per year. Energy consumption would be about 25 percent lower under this scenario.	Energy consumption would be lower than the project under this scenario. Total electrical consumption would be 846,840,880 Kwh per year, while natural gas consumption is estimated to be 5,706,602,355 cubic feet per year. This alternative would yield a slight reduction in natural gas consumption, and electrical consumption would decrease by about 20%.	Energy consumption would be higher than the project under this scenario. Total electrical consumption would be 1,066,958,145 while natural gas consumption is estimated to be 6,577,330,295 cubic feet per year.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Telephone and Cable	Buildout of the Planning Area will add to the overall demand for telephone and cable television services. GTE has indicated that they are committed to serving the Planning Area, although extension of telephone lines would occur only as development progresses.	Buildout under existing General Plans would result in less urbanization and, therefore, less demand for telephone and cable television services.	Buildout under this alternative would result in less urbanization and, therefore, less demand for telephone and cable television services.	Buildout under this alternative would result in less urbanization and, therefore, less demand for telephone and cable television services.	Since this alternative affects industrial land only, there would be a proportionate reduction in telephone demand. Demand for cable television would not be substantially affected.	Buildout under this alternative would result in an increase of 2,200 residential dwelling units and a proportionate increase in demand for television and cable television service over the project. Nonresidential demand for telephone service would also increase. This additional demand would occur in the southern portion of the study area which is currently in agricultural production. The extension of telephone and cable television lines would be paid by the project.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
PUBLIC SERVICES Law Enforcement	The project will create additional demand for police services due to increases in population, housing and other development. Development will be evaluated on a project-specific basis. Currently police services are adequately funded by the City's General Fund which comes primarily from sales and property taxes. Future impacts may warrant collection of impact fees on all new construction as mitigation in the event current funding becomes inadequate.	Would result in higher non-residential development and lower population than the project. Currently police service funds are allocated by the City's General Fund which comes primarily from sales and property taxes. It is anticipated that higher property valuation will adequately support future police department funding, however, it may be necessary to impose development impact fees on new construction at some point.	Would result in slightly lower demand for police services due to reduction in commercial and residential uses.	Would significantly reduce population compared with the project. Fewer new officers would be required under this plan.	No new residential or population would be added under this alternative. Demand for police services would decrease slightly due to reductions in industrial land.	Addition of 2,200 dwelling units would increase population by about 6,100 persons thus creating the need for more officers than under the project. The addition of 6.4 million square feet of non-residential uses could also contribute to additional law enforcement services. This would be mitigated by development impact fees.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Fire and Paramedic Services	The proposed Plan will create additional demands on existing fire protection and paramedic services due to the increase in structures and population in the Planning Area. Development will be evaluated on a project-specific basis by the appropriate agency to determine potential impacts and mitigation.	Due to lower population, demand for fire protection and paramedic services would decrease in comparison with the project. Development would be evaluated on a project specific basis to determine impacts and mitigation.	Would result in slightly lower demand for fire and paramedic services due to reduction in commercial and residential uses.	Reduced impacts over proposed project since reduction of 7,800 units in the Mecca Hills would result in a proportionate decrease in fire protection services.	Would replace 25% industrial development with agriculture which would reduce potential structural fire hazards.	Demand for fire protection services would increase due to the addition of 2,200 dwelling units and 6.4 million square feet of non-residential uses. Development would be evaluated on a project specific basis to determine impacts and mitigation.
Parks and Recreation	The project will create additional demands on the City's parks and recreational services. However, General Plan policies serve to encourage preserving the park system and development of new parks. Would meet City's park standard of 5 to 6 acres per 1,000 residents.	With the second highest population estimate, this alternative would create greater demands on park services than the project. Existing General Plan policies do not adequately address the provision of parks and recreational facilities.	Demand for parks and recreational services would be slightly lower due to 18% decrease in the number of dwelling units.	Would reduce demands on the park system due to lower population and employment projections. Therefore, less parkland would need to be developed.	With the highest population estimates, this would create more demand on park services than the project. However, this is somewhat offset by the substantial decrease in employment.	Based on population to parkland ratios, increased population and employment projected with this alternative would increase the demand for parkland and facilities. This would also shift the distribution of needed parkland to the south.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Schools	Total enrollment at buildout is projected to be 63,817 students, creating a substantial deficit between available capacity at existing schools and projected enrollment, thus requiring the construction of new schools. Policies in the General Plan are designed to mitigate this projected school deficiency but without established funding sources, population growth may out pace the construction of new schools over time. This is considered a significant unmitigable impact.	Under existing General Plans, total enrollment would decrease by about 37,014 students (42%) from the proposed project. This would still substantially exceed existing school capacity, however, and since funding sources would not change, impacts would be similar to the proposed project.	Under this alternative, total enrollment would decrease by about 49,777 students (22%) from the proposed project. This would still substantially exceed existing school capacity, however, and since funding sources would not change, impacts would be similar to the proposed project.	Under this alternative, total enrollment would decrease by about 53,606 students (16%) from the proposed project. This would still substantially exceed existing school capacity, however, and since funding sources would not change, impacts would be similar to the proposed project. School sites to serve the Mecca Hills would not be necessary.	Under this alternative, total enrollment would remain approximately the same as the proposed project. Consequently, school impacts would be identical to the proposed project. School fees would not be collected on 25% less industrial land.	Under this alternative, total enrollment would increase by about 66,370 students (4%) from the proposed project. This would still substantially exceed existing school capacity, however, and since funding sources would not change, impacts would be similar to the proposed project. New schools would be needed in the southern portion of the study area.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Health Facilities	The proposed project would result in a population of approximately 153,511 at buildout, a 483% increase over existing population, and creating a proportionate demand for new health services and facilities. Because the creation of new and expanded health facilities is driven by market demand, impacts are not anticipated to be significant.	Under this alternative, population would decrease by approximately 63,500 persons thus reducing the demand for health facilities. Because the creation of new and expanded health facilities is driven by market demand, impacts are not anticipated to be substantially different than the project.	Under this alternative, population would decrease by approximately 27,600 persons thus reducing the demand for health facilities. Because the creation of new and expanded health facilities is driven by market demand, impacts are not anticipated to be substantially different than the project.	Under this alternative, population would decrease by approximately 24,500 persons thus reducing demand for health facilities. Because the creation of new and expanded health facilities is driven by market demand, impacts are not anticipated to be substantially different than the project.	Under this alternative, residential units and therefore population would be the same as the proposed project, thus creating no added demand for health facilities. Because the creation of new and expanded health facilities is driven by market demand, impacts are not anticipated to be significantly different than the project.	Under this alternative, population would increase by approximately 6,100 persons, thus creating added demand for health facilities. Because the creation of new and expanded health facilities is driven by market demand, impacts are not anticipated to be significantly different than the project.
Library Facilities	The proposed project would result in the need for adequate facilities and books to serve a population of 153,511 a substantial increase over existing facilities requiring 152,664 volumes and 63,610 square feet to meet RCCPL's goal of 1.2 volumes and 0.5 square feet per resident. General Plan policies mitigate this impact by requiring that these ratios be satisfied.	Under this alternative, a decrease in population of approximately 63,500 persons would reduce the necessary amount of library facility square footage and books by approximately 42%.	Under this alternative, a decrease in population of approximately 27,600 persons would reduce the necessary amount of library facility square footage and books by approximately 22%.	Under this alternative, a decrease in population of approximately 24,500 persons would reduce the necessary amount of library facility square footage and books by approximately 16%.	Under this alternative, residential units and therefore population would not be directly affected. Consequently the need for library facilities and books would be approximately the same as the proposed project.	Under this alternative, an increase in population of approximately 6,100 persons would increase the necessary amount of library facility square footage and books by approximately 4%.

Topic	Proposed Project	Alternative #1 Existing General Plans (No Project)	Alternative #2 Agricultural Preservation	Alternative #3 Mecca Hills Preservation	Alternative #4 25% Industrial Reduction	Alternative #5 Kohl Ranch
Public Transportation	The project will result in an increase in development and population which will create additional demand for public transportation. General Plan policies are designed to mitigate these impacts.	Under this alternative, urbanized areas in the valley floor would be reduced resulting in both a reduction in the area requiring service by public transit and a reduction in overall ridership.	Under this alternative, urbanized areas in the valley floor would be reduced resulting in both a reduction in the area requiring service by public transit and a reduction in overall ridership.	Under this alternative, urbanized areas would be reduced in the Mecca Hills. Because this area is rural in character and is therefore not conducive to effective transit service, effects on public transit are not expected to be great. Impacts would not differ substantially from the proposed project.	Under this alternative, the amount of industrial land would be reduced 25%. Because 75% of industrial would remain, the areas requiring public transit are not expected to change appreciably. Impacts would not differ substantially from the project except for some reduction in ridership.	Under this alternative, new development bringing increased population would occur in the southern portion of the study area thus requiring transit service to be extended significantly to the south. Thus the area served by transit would increase as would overall ridership.
Mineral Resources	The proposed General Plan preserves the majority of lands designated as having significant mineral resources within the Planning Area and meets the Planning Area's contribution to regional needs.	Similar to the project in that the majority of regionally significant mineral resources would be preserved under the "Desert" designation which allows 1 unit per 10 acres. This scenario would preserve slightly less mineral resources because no open space designations which preclude development within mineral resource zones are identified.	Would not differ from the project in the amount of mineral resources which would be preserved.	No significant difference from the project in that the majority of mineral resource zones would remain undeveloped under this scenario.	Would not differ from the project in the amount of mineral resources which would be preserved.	Would not differ from the project in the amount of mineral resources which would be preserved.

6.0 Report Preparation Staff and Consultation Record

6.0 REPORT PREPARATION STAFF AND CONSULTATION RECORD**A. Report Preparation Staff****Lead Agency**

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Paul DePalatis, AICP, Director of
Planning Services
David Merriman, Project Planner
Ginger Nuhn, Research Planner/Biologist
Jessica Morin, Graphics
Kathleen Mayock, Word Processing

Geologic Consultant

Steven C. Suitt & Associates
30020 Windward Drive
Canyon Lake, California 92656

Steven C. Suitt, CEG

Biological Consultant

Natural Heritage Foundation
P.O. Box 2865
Big Bear Lake, California 92315-2865

Bob Lindblad

Cultural Resources Consultant

CRM TECH
126 Barrett Road
Riverside, California 92507

Bruce Love

Traffic, Air Quality, and Noise Consultant

Endo Engineering
95 Argonaut, Suite 115
Aliso Viejo, California 92656

Gregory Endo
Vicki Endo

Fiscal/Economic Consultant

Shannon, Davis & Associates
11150 Santa Monica Boulevard, Suite 200
Los Angeles, California 90025

Jim Williams

B. Agencies, Organizations & Persons Consulted

Bowie, Arneson, Kadi, Wiles & Giannone for
Coachella Valley Unified School District
CALTRANS
City of Coachella Public Works Department
Coachella Valley Parks and Recreation District
Coachella Police Department
Coachella Valley Water District

Continental Cable
CVAG

Dangermond & Associates
Desert Sands Unified School District
Eastern Information Center, Department of Anthropology,
University of California, Riverside
El Progreso del Desierto
General Telephone and Electric
Herbarium, University of California, Riverside
Imperial Irrigation District
John F. Kennedy Memorial Hospital
Riverside City and County Public Library
Riverside County
Riverside County Fire Department
Riverside County Waste Resources Management District

San Bernardino County Museum
The Gas Company

Sunline Transit

Western Waste Industries

Kenneth S. Levy, Attorney at Law
Paul Hardin, Project Engineer (SR 86)
John Curtis, Director
Don Martin, District Manager
Anita Singletary, Administrative Assistant
Tom Levy, General Manager
Daniel Farris, Stormwater Engineer
Joseph Cook, Planning Engineer
Michael Schaefer, Irrigation Engineer
Bruce Clark, Sanitation Engineer
John Corella, Domestic Water Engineer
James H. Dunham, Construction Manager
Diana Beck, AICP, Director - Department
of Planning
Bill Havert, Consultant
Pauline Pierson, Clerk

Kay White, Administrative Assistant
Victor Rodriguez, Director
Bill Morrow, Service Planner
Andrew Sanders, Curator
Thomas Lyons, JR., P.E., Senior Engineer
Jane Hyde, Marketing Coordinator
Irene Liebenberg, Administrative Assistant
Keith Downs, Interim Airport Director
John Rios, Battalion Chief
Sung Key Ma
Kathy Gifford, Planner III
Bob Reynolds, Paleontologist
John P. DeWitt, Technical Supervisor
Art Escobedo, Service Planner.
Leslie Grosjean, Service Development
Assistant
Jim Brockman, District Manager

7.0 Bibliography

7.0 BIBLIOGRAPHY

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CITY OF COACHELLA

TECHNICAL APPENDIX TO THE

GENERAL PLAN

DRAFT

ENVIRONMENTAL IMPACT REPORT

State Clearinghouse #96071011

MARCH 1997

Prepared for:

City of Coachella
1515 Sixth St.
Coachella, California 92236
(619)398-3102

Prepared by:

Smith, Peroni & Fox, Planning Consultants, Inc.
225 South Civic Drive, Suite 1-5
Palm Springs, California 92262
(619)322-0900

CITY OF COVINGTON

TECHNICAL ASSISTANCE TO THE

GENERAL PLAN

DRAFT

ENVIRONMENTAL IMPACT REPORT

Page 1 of 100

MARCH 1989

Page 2 of 100

City of Covington
Environmental
Department
1000 North
Main Street
Covington, Louisiana 70038

Page 3 of 100

City of Covington
Environmental
Department
1000 North
Main Street
Covington, Louisiana 70038

A. Notice of Preparation

NOTICE OF COMPLETION

State of California
Office of Planning & Research
1400 Tenth Street
Sacramento, CA 95814

Project Title: **Proposed City of Coachella General Plan 2020 Environmental Impact Report
State Clearinghouse #96071011**

Project Location - Specific: The City of Coachella is located in the southwestern portion of the Coachella Valley in Riverside County, California. The Study Area for the General Plan update includes the incorporated City of Coachella, its Sphere of Influence, and other surrounding areas which could have an effect on the planning process in the City. The study area is generally the area bounded by Monroe Street on the west, Avenue 62 on the south, Johnson Street on the east and by Avenue 44 on the north. Figures 1 and 2 show the regional location of the City and Figure 3 shows the Planning Area boundary.

Project Location - City: **City of Coachella**

Project Location - County: **Riverside County**

Description of Nature, Purpose, and Beneficiaries of Project: This Environmental Impact Report (EIR) has been prepared to assess impacts associated with the City of Coachella General Plan Update. It analyzes the effects of the goals, policies, and programs, as well as the environmental impacts associated with the proposed land use and circulation patterns. The General Plan is mandated by State law and requires each City and County to prepare a long-range, comprehensive plan for the physical development of the jurisdiction and may land outside its boundaries which the agency deems relevant for planning purpose. The General Plan is also intended as the document which will ensure adequate services and infrastructure, preserve and protect the environment, manage natural resources and provide economic programs and assistance.

The purpose of this document is to provide the lead agency, City of Coachella, other responsible or interested agencies and the public with information to be used in evaluating the environmental issues and potential impacts associated with adoption and implementation of the proposed General Plan.

The scope of the EIR was determined by City Planning staff through completion of an Initial Study which is part of the Notice of Preparation (NOP) for the General Plan Environmental Impact Report.

The proposed actions subject to environmental review in this EIR include certification of the EIR, approval of the proposed General Plan Update and General Plan Land Use Maps, approval of updated zoning maps, and adoption of CEQA findings pursuant to the CEQA Guidelines Section 15091.

This EIR is intended to be used to allow "tiering" of the environmental review process for future public and private development under the General Plan such as tract maps, specific plans, and other development proposals. It is also intended as an informational base for subsequent zoning ordinance revision.

Lead Agency: City of Coachella, California

Address Where Copy of EIR is Available: City of Coachella, Community Development Department
1515 Sixth Street, Coachella, California 92236

Review Period: April 16, 1997 through May 31, 1997

Contact Person: Susan E. Williams
Director of Community Development, City of Coachella, CA.

Area Code/Phone/Extension: (760) 398-3102

Notice of Completion

Mail to: State Clearinghouse, 1400 Tenth Street, Sacramento, CA 95814 916/445-0613

SCH # 96071011

Project Title: City of Coachella General Plan 2020 Draft EIR

Lead Agency: City of Coachella

Contact Person: Susan E. Williams

Street Address: 1515 Sixth Street

Phone: (760) 398-3102

City: Coachella, CA **Zip:** 92236

County: Riverside

Project Location:

County: Riverside

City/Nearest Community: Coachella

Total Acres: 53,529 acres

Cross Streets: Monroe Street to Johnson Street, Avenue 44 to Avenue 62

Twps: portions of T5S and T6S **Ranges:** portions of R7E, R8E, R9E

Base: San Bernardino Base & Meridian

Within 2 Miles: State Hwy #: I10, Hwy 111, Hwy 86, Expwy 86

Waterways: All-American Canal, Coachella Valley Storm Channel

Airports: Thermal Airport

Railways: Southern Pacific Railroad

Schools: Coachella Valley Unified School District

Document Type: CEQA Draft EIR

Local Action Type: General Plan Update

Development Type:

Residential: Units: 50,497 **Nonresidential:** Sq. Ft.: 61,361,700 **Total Acres:** 53,529

Project Issues Discussed in Document

Aesthetic/Visual	Flood Plain/Flooding	Schools	Water Quality
Agricultural Land	Geologic/Seismic	Septic Systems	Water Supply/Groundwater
Air Quality	Minerals	Sewer Capacity	Wetland/Riparian
Archaeological/Historical	Noise	Soil Erosion/Compaction/Grading	Wildlife
Drainage/Absorption	Population/Housing Balance	Solid Waste	Growth Inducing
	Public Services/Facilities	Traffic/Circulation	Land Use
	Recreation/Parks	Vegetation	Cumulative Effects

Present Land Use / Zoning / General Plan Use: See attached Figures 8 and 9

Project Description:

This Environmental Impact Report (EIR) has been prepared to assess impacts associated with the City of Coachella General Plan Update. It analyzes the effects of the goals, policies, and programs, as well as the environmental impacts associated with the proposed land use and circulation patterns. The General Plan is mandated by State law and requires each City and County to prepare a long-range, comprehensive plan for the physical development of the jurisdiction and any land outside its boundaries which the agency deems relevant for planning purposes. The General Plan is also intended as the document which will ensure adequate services and infrastructure, preserve and protect the environment, manage natural resources and provide economic programs and assistance.

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Reviewing Agencies Checklist

KEY

S = Document sent by lead agency

X = Document sent by SCH

✓ = Suggested distribution

____ Resources Agency
____ Boating & Waterways
____ Coastal Commission
____ Coastal Conservancy
____ Colorado River Board
____ Conservation
____ Fish & Game
____ Forestry
____ Office of Historic Preservation
____ Parks & Recreation
____ Reclamation
____ S.F. Bay Conservation & Development Commission
____ Water Resources (DWR)

Business, Transportation & Housing

____ Aeronautics
____ California Highway Patrol
____ CALTRANS District # _____
____ Department of Transportation Planning (headquarters)
____ Housing & Community Development

Food & Agriculture

Health & Welfare

____ Health Services _____

State & Consumer Services

____ General Services
____ OLA (Schools)

Environmental Affairs

____ Air Resources Board
____ APCD/AQMD
____ California Waste Management Board
____ SWRCB: Clean Water Grants
____ SWRCB: Delta Unit
____ SWRCB: Water Quality
____ SWRCB: Water Rights
____ Regional WQCB # _____ (_____)

Youth & Adult Corrections

____ Corrections

Independent Commissions & Offices

____ Energy Commission
____ Native American Heritage Commission
____ Public Utilities Commission
____ Santa Monica Mountains Conservancy
____ State Lands Commission
____ Tahoe Regional Planning Agency

____ Other _____

Public Review Period (to be filled in by lead agency)

Starting Date April 16, 1997

Ending Date May 31, 1997

Signature Susan E. Williams

Date April 11, 1997

Lead Agency (Complete if applicable):

Consulting Firm: _____

Address: _____

City/State/Zip: _____

Contact: _____

Phone: (____) _____

Applicant: _____

Address: _____

City/State/Zip: _____

Phone: (____) _____

For SCH Use Only:

Date Received at SCH _____

Date Review Starts _____

Date to Agencies _____

Date to SCH _____

Clearance Date _____

Notes:

CITY OF COACHELLA

DEPARTMENT OF COMMUNITY DEVELOPMENT

ENVIRONMENTAL DOCUMENTS, PERMITS AND LAND USE REVIEW

The City of Coachella is requesting comments regarding **Environmental Impact Report #96-1** prepared pursuant to the California Environmental Quality Act (CEQA) and/or National Environmental Policy Act (NEPA) for the above referenced projects. Your comments are requested with respect to:

- Physical impacts of the project on public resources, facilities, and/or services;
- Recommended conditions that your agency believes would mitigate any potential, adverse environmental impacts; or
- Input regarding the impacts that you may identify that you believe may cause any significant potential, adverse environmental impacts which cannot be avoided through conditions imposed as mitigation measures. Please recommend the scope and focus of additional studies which may be helpful in identifying the environmental impacts and mitigation measures.
- Recommended changes and/or additions that your agency believes would improve the applicability of the proposed amendments within the scope of your agency's authority or would satisfy other regulations and concerns for which your agency is responsible.

Please respond in writing by May 31, 1997, so that we may include your input in the analysis and recommendations regarding City of Coachella General Plan 2020. Please type or print legibly so that we may correctly include your comments.

Environmental Impact Report # 96-1, City of Coachella General Plan 2020 EIR, SCH #96071011

Comments made by: _____ Date: _____

Printed Name & Title: _____

Agency: _____ Telephone: _____

Please return your comments to:
CITY OF COACHELLA
Department of Community Development
1515 Sixth Street
Coachella CA 92236

The City of Chicago is requesting a meeting to discuss the proposed project with the City of Chicago and the Illinois Department of Transportation. The meeting will be held on the 15th of October, 2010, at 10:00 AM, in the City of Chicago, Illinois.

The meeting will be held in the City of Chicago, Illinois, at the following address:

City of Chicago, Illinois
100 North Dearborn Street
Chicago, Illinois 60610

The meeting will be held in the City of Chicago, Illinois, at the following address:

City of Chicago, Illinois
100 North Dearborn Street
Chicago, Illinois 60610

The meeting will be held in the City of Chicago, Illinois, at the following address:

Environmental Impact Report - 10-1 City of Chicago, Illinois, 100 North Dearborn Street, Chicago, Illinois 60610

City of Chicago, Illinois, 100 North Dearborn Street, Chicago, Illinois 60610

City of Chicago, Illinois, 100 North Dearborn Street, Chicago, Illinois 60610

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City of Chicago, Illinois, 100 North Dearborn Street, Chicago, Illinois 60610

City of Chicago, Illinois, 100 North Dearborn Street, Chicago, Illinois 60610

CITY OF COACHELLA

DISTRIBUTION CHECKLIST FOR ENVIRONMENTAL DOCUMENTS, TENTATIVE MAP REVIEW, AND DESIGN REVIEW

E.I.R. Number 96-1 State Clearinghouse # 96071011

☒ Imperial Irrigation
☒ Southern California Gas Company
☒ General Telephone (Engineering)
☒ General Telephone (Planning)
☒ Coachella Postmaster
☒ Sunline Transit Agency
☒ Colony Cablevision
☒ Coachella Sanitary District
☒ Western Waste
☒ Coachella Public Works Department
☒ Coachella Police Department
☒ Riverside County Fire Department
☒ Building Official
☒ Community Development Director
☒ CVEZA
☒ Coachella Valley Water District

ALL PROJECTS NORTH OF I-10

☒ Southern California Gas Company

IF RESIDENTIAL PROJECT

☒ Coachella Valley Park & Recreation District

CHOOSE CORRECT DISTRICT/SEND ALL EA'S

☒ Coachella Valley Unified School District
☒ Desert Sands Unified School District

IF SEPTIC TANKS OR REGIONAL HEALTH CONSIDERATIONS, i.e. NOISE

☒ Riverside County Health Department

IF SEPTIC TANKS

☒ California Regional Water Quality

IF ARCHAEOLOGICAL SIGNIFICANCE

☒ Cabazon Band of Mission Indians
☒ 29 Palms Band of Mission Indians
☒ Augustine Indians
☒ Torres Martinez Indians

IF UNDERGROUND TANKS

☒ Riverside County Health Department

IF SEISMIC OR GEOLOGIC ISSUES

☒ Steve Kupferman, Geologist, County of Riverside

IF OUTSIDE CITY OR ON BOUNDARY

☒ Riverside County Transportation
☒ Riverside County Administration Office
☒ Riverside County Planning Department

IF FOOD SERVICE OR SALES

☒ Riverside County Environmental Health Dept.

IF IN AIRPORT AREA

☒ Riverside. Co. Airport Land Use Commission
☒ Thermal Airport
☒ CalTrans Aeronautics Division
☒ FAA - Airports Division

IF LANDSCAPING IS PART OF PROJECT

☒ Agricultural Commissioner's Office

IF REQUIRED CLEARINGHOUSE REVIEW

☒ California State Clearinghouse
☒ California Office of Planning & Research (10)

IF CLEARINGHOUSE REVIEW OR AIR QUALITY REVIEW NEEDED

☒ SCAG - Southern Ca. Assoc. of Government
☒ South Coast Air Quality Management District.

IF ANNEX/SPHERE OF INFLUENCE

☒ LAFCO / Local Agency Formation Com.
☒ CVAG / Coachella Valley Assoc. of Gov.
☒ City of Indio
☒ City of La Quinta

IF ON HIGHWAY 111 / 86 FRONTAGE

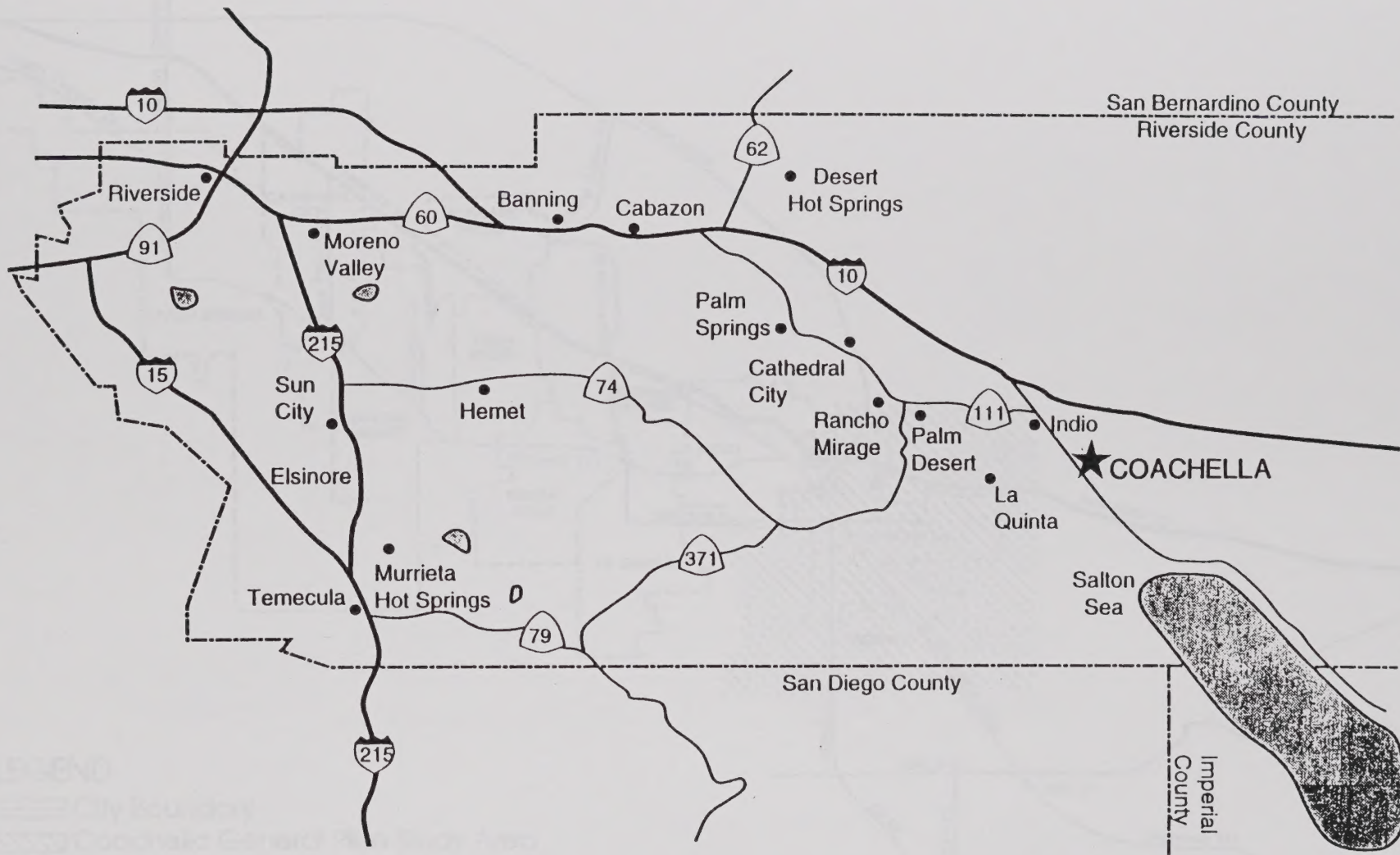
☒ CalTrans District 8, San Bernardino

OTHER

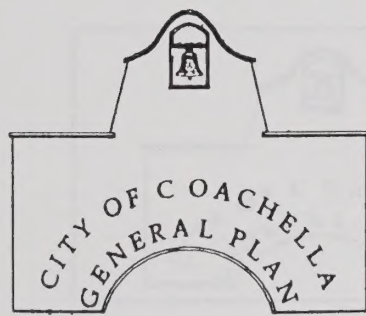
☒ Coachella Library (GP, EIR, & Notices)
☒ Max T. McCandless Regional Library, Indio
(GP, EIR, & Notices)
☒ Assemblyman Jim Battin
☒ State Senator David Kelley
☒ Honorable Sonny Bono, US House of Representatives
☒ US Senator Barbara Boxer
☒ US Senator Diane Feinstein

Date Mailed / Initials: April 11, 1997 By: _____
Return Date Requested: May 31, 1997

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N Not to Scale



Regional Map

Smith, Perout & Fox, Planning Consultants, Inc.
 225 S. Civic Dr. Suite 1-3 Palm Springs, CA 92262

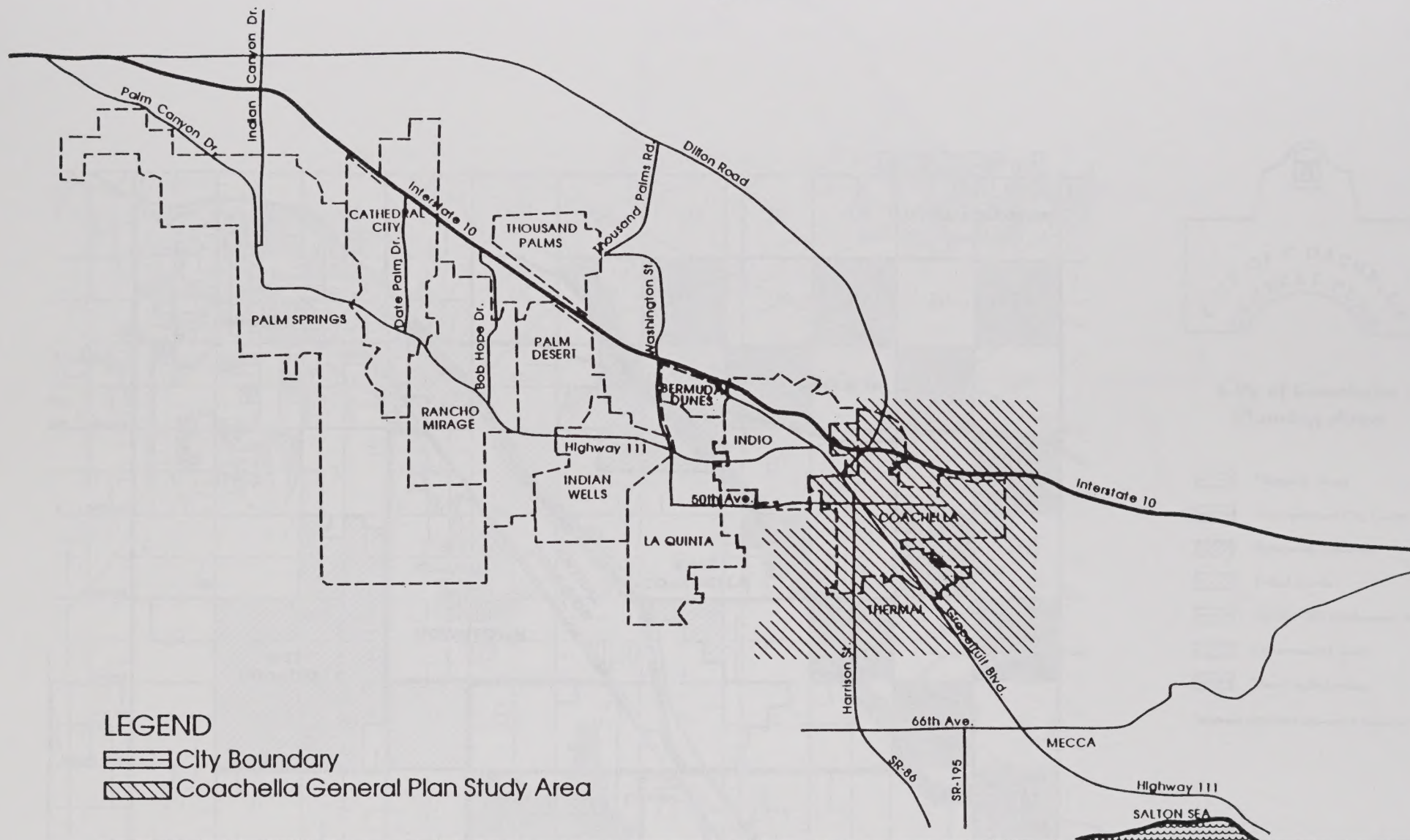
Figure 1



Map of the Study Area



Map of the Study Area



LEGEND

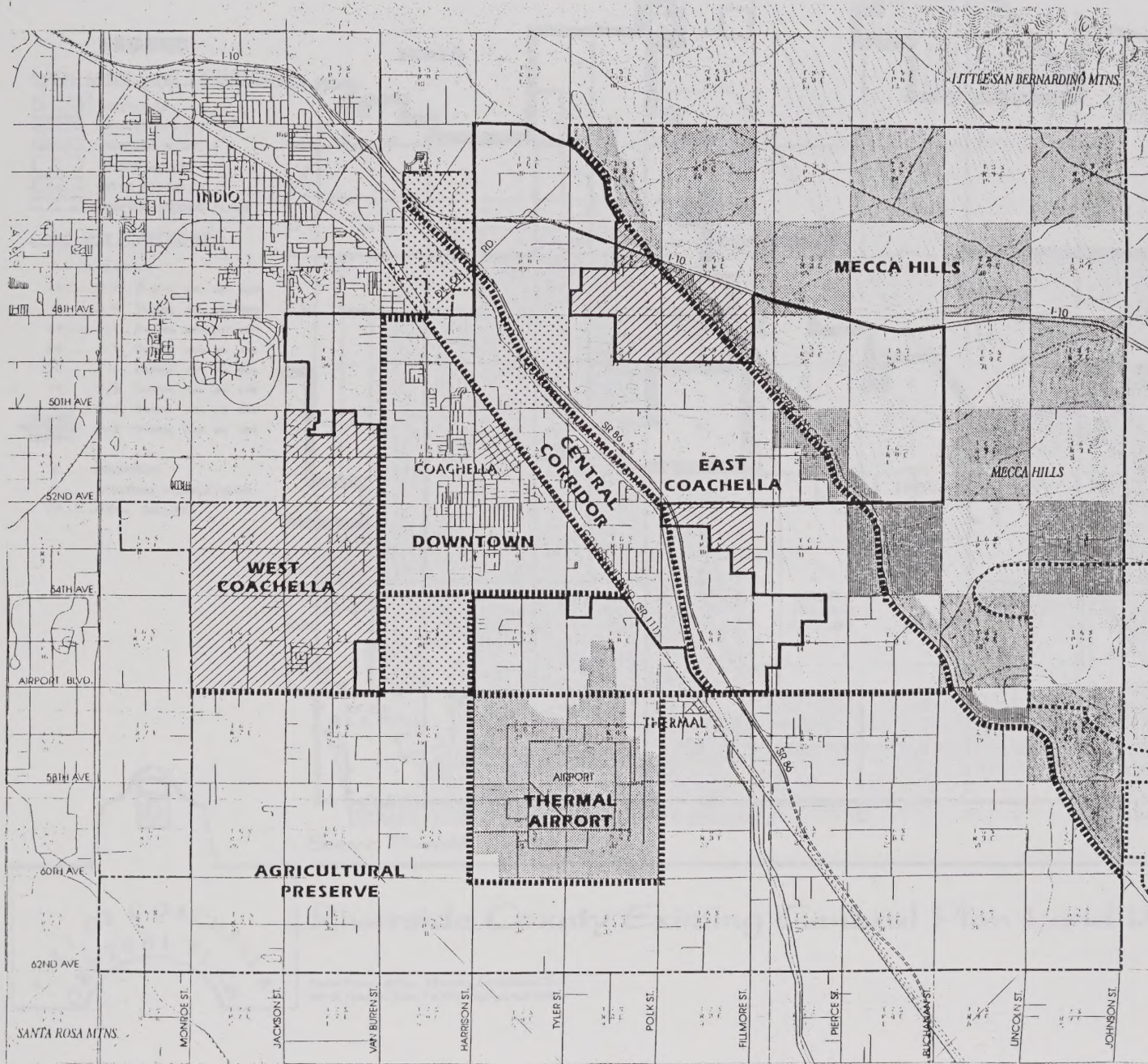
--- City Boundary

▨ Coachella General Plan Study Area

	TITLE: Vicinity Map	SMITH, PERONI & FOX
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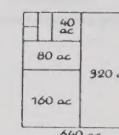
Figure 2



City of Coachella Planning Area

- Planning Area
- Incorporated City Limits
- Sphere of Influence
- Tribal Lands
- Mecca Hills Wilderness Area
- Government Lands*
- Planning Subareas

* Exclusive of R.O.W.'s easements & flood control facilities



Source:
LAFCO, City of Coachella

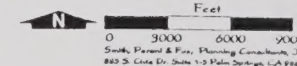


Figure 3
Page 4



Map of the Study Area

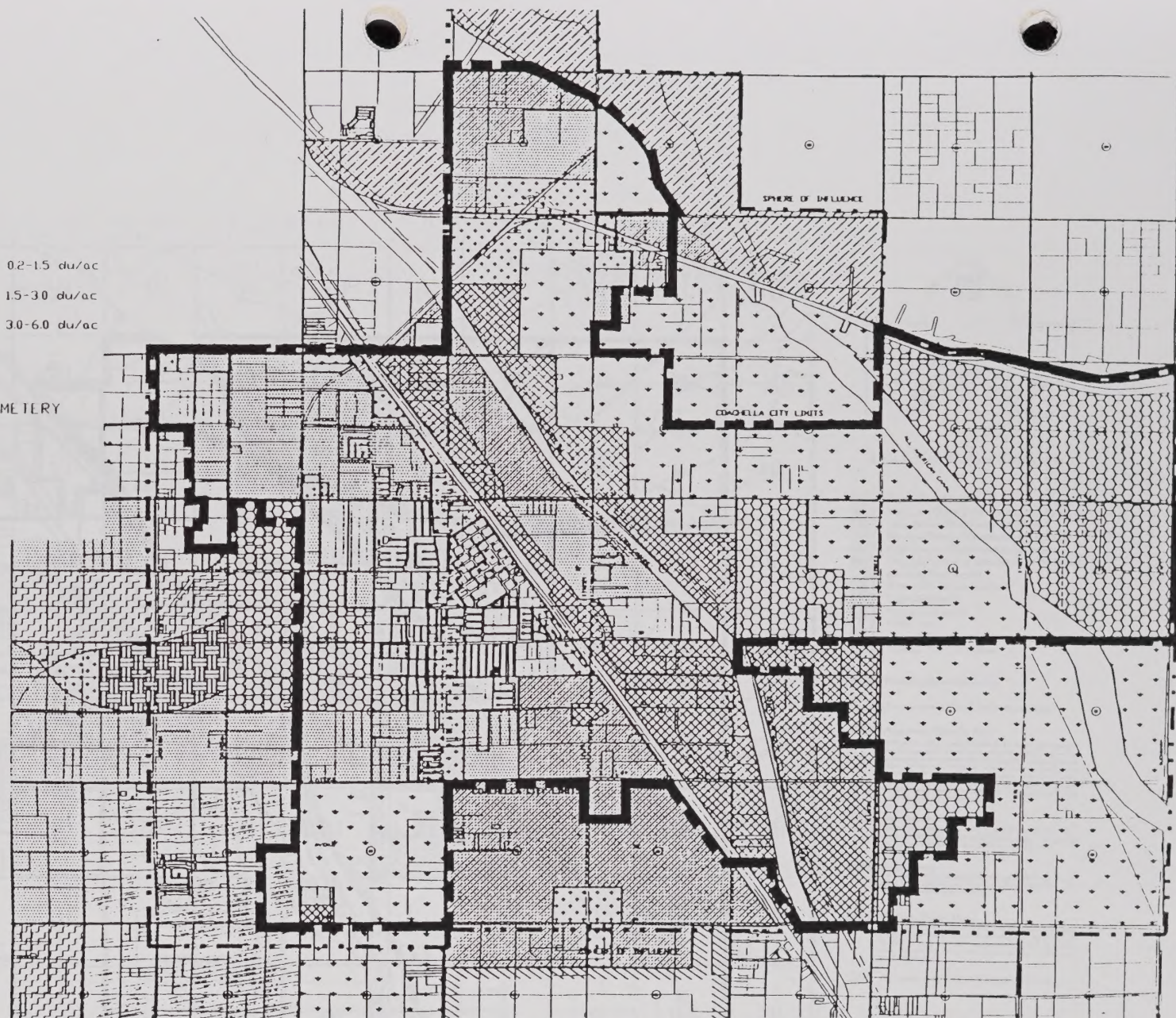


Map of the Study Area

Grid	Study Area	Map of the Study Area
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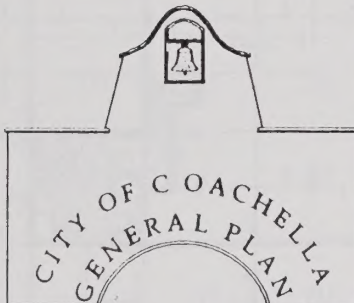
LEGEND

	AGRICULTURE	
	DESERT	
	RURAL RESIDENTIAL	02-15 du/ac
	SUBURBAN RESIDENTIAL	15-30 du/ac
	URBAN RESIDENTIAL	30-60 du/ac
	RESORT	
	GENERAL COMMERCIAL	
	PUBLIC/QUASI PUBLIC	
	CEMETERY	
	LIGHT INDUSTRIAL	
	GENERAL INDUSTRIAL	
	SPECIFIC PLAN	
	AIRPORT	



Source: City of Coachella

Not to Scale



City of Coachella Existing General Plan Land Use January, 1987

Smith, Peroni & Fox, Planning Consultants, Inc.
885 S. Olive Dr. Suite 1-5 Palm Springs, CA 92262

Figure 9



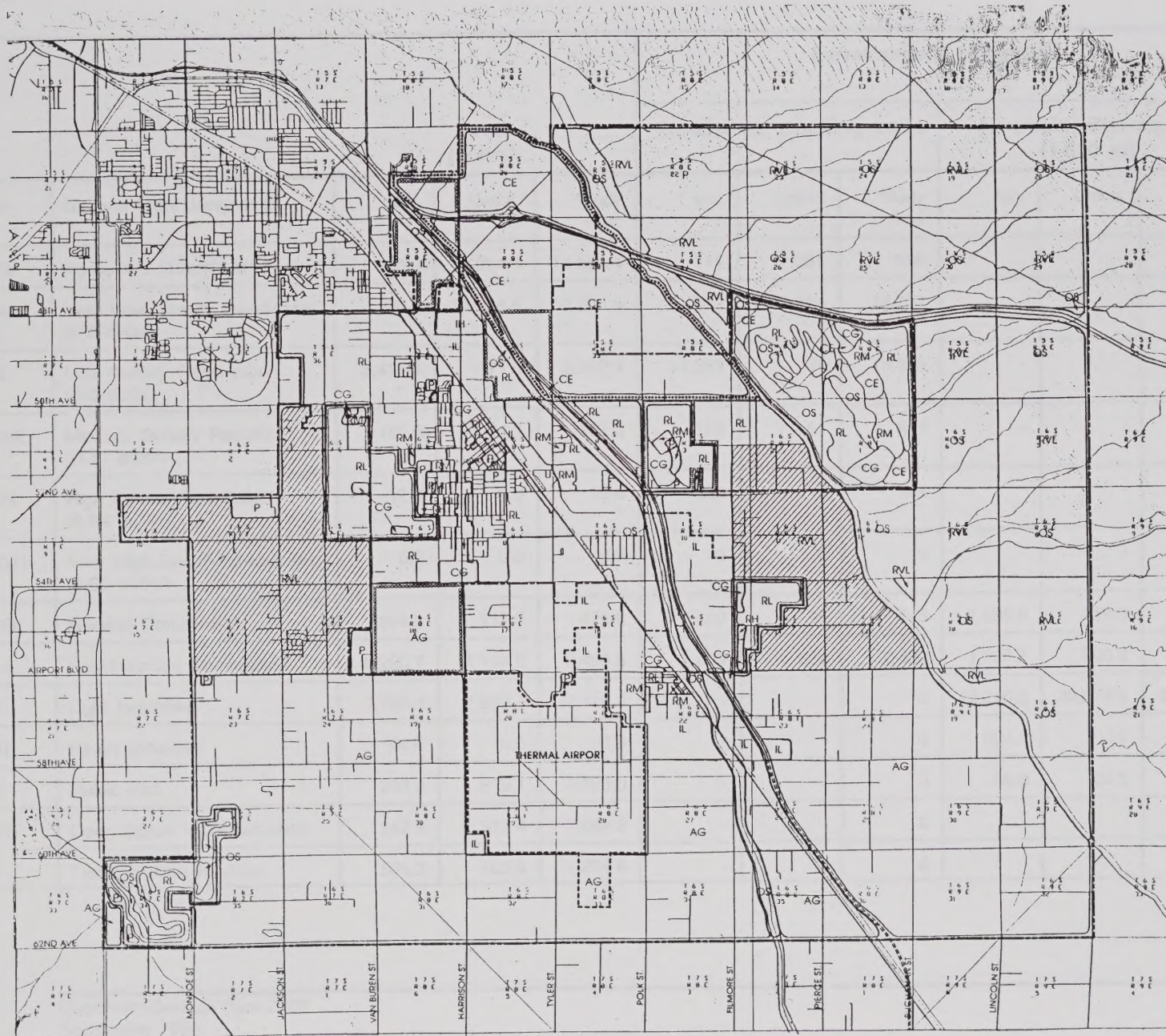
NSF Grant Number: 10080000

Journal Title: *Journal of Environmental Science and Technology*



Legend

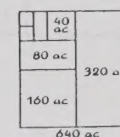
- Parcel boundaries
- Parcel numbers
- Parcel names
- Parcel area
- Parcel volume
- Parcel value
- Parcel status
- Parcel type
- Parcel use
- Parcel owner
- Parcel date
- Parcel source
- Parcel notes



Land Use Policy Diagram

AG	Agriculture (1d/40ac)
RVL	Very Low Density Residential (0-2d/40ac)
RL	Low Density Residential (0-5d/40ac)
RM	Medium Density Residential (0-10d/40ac)
RH	High Density Residential (0-20d/40ac)
RVH	Very High Density Residential (0-30d/40ac)
CG	General Commercial
CE	Entertainment Commercial
IL	Light Industrial
IH	Heavy Industrial
P	Public Use
OS	Open Space/Conservation
T	Transportation Facilities

- Planning Area Boundary**
- Incorporated City Limits (March 1990)**
- Approved Specific Plan**
Within these areas, the approved Specific Plan is the official General Plan land use diagram, including maximum allowable residential density and commercial floor space. Land use design is not in the General Plan Land Use Policy Diagram, which is under the Specific Plan boundary and illustrates only the general pattern of residential use and the general pattern of commercial use. The Specific Plan should be consulted for a detailed understanding of allowable land use and maximum density/height.
- Entertainment Area Plan**
This is an area of special interest to the City of Coachella which will be further refined through the use of height, density, floor area ratio, and other planning and development standards.
- Tribal Land**
Tribal lands include properties under the control of Native American groups including the Colorado Shoshone, the 99th Indian Band of Colorado Shoshone and the Argentine Indians.
- Airport Master Plan**
This is an area of special interest to the City of Coachella which will be further refined through the use of height, density, floor area ratio, and other planning and development standards.
- Agriculture to Urban Transition Area**



Source:
City of Coachella
Smith, Perini & Fox

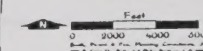


Figure 10



**FIGURE 11
CITY OF COACHELLA
SUMMARY OF LAND USE DESIGNATIONS**

					Development Magnitude								
					Residential dwelling units			Nonresidential sq. ft. (1,000 sf)					
Area (acres)													
GP	General Plan Designation	Inc.	Uninc.	Study Area	Inc.	Uninc.	Study Area	Inc.	Uninc.	Study Area	Inc.	Uninc.	Study Area
AG	Agriculture (1du/40 ac)	648.0	13,914.4	14,562.4	15	581	596	-	-	0.0	46	1,766	1,812
RVL	Very Low Density Residential (0-2 du/ac)	280.0	10,346.5	10,626.5	403	13,854	14,257	-	-	0.0	1,225	42,116	43,341
RL	Low Density Residential (0-8 du/ac)	3,431.4	471.0	3,902.4	14,293	32	14,325	-	-	0.0	43,451	97	43,548
RML	Medium Density Residential (0-10 du/ac)	148.5	14.3	162.8	760	51	811	-	-	0.0	2,310	155	2,465
RH	High Density Residential (0-20 du/ac)	12.0	0.0	12.0	184	0	184	-	-	0.0	559	0	559
RVH	Very High Density Residential (0-30 du/ac)	0.0	0.0	0.0	0	0	0	-	-	0.0	0	0	0
CG	General Commercial	365.0	110.0	475.0	500	45	545	1,295.9	119.0	1,414.9	1,520	137	1,657
CE	Entertainment Commercial	2,290.7	1,194.8	3,485.5	1,596	833	2,429	1,737.7	906.4	2,644.1	4,852	2,532	7,384
IL	Light Industrial	1,788.3	2,650.1	4,438.4	-	-	0	19,710.5	30,278.5	49,989.0	0	0	0
IH	Heavy Industrial	90.0	0.0	90.0	-	-	0	994.4	0.0	994.4	0	0	0
P	Public Use	283.9	819.1	1,103.0	-	-	0	65.8	23.5	89.3	0	0	0
OS	Open Space - Conservation	512.8	6,577.4	7,090.2	-	-	0	-	-	0.0	0	0	0
T	Transportation Facilities	501.3	703.5	1,204.8	-	-	0	-	-	0.0	0	0	0

No.	Description of work	Unit	Quantity	Unit Price	Total Price	Material	Labor	Overhead	Profit	Total	Remarks
1	Excavate and backfill	cu yd	100	1.00	100.00	100	100	100	100	400	
2	Gravel base	sq yd	100	1.00	100.00	100	100	100	100	400	
3	Asphalt concrete	sq yd	100	1.00	100.00	100	100	100	100	400	
4	Paint	gal	100	1.00	100.00	100	100	100	100	400	
5	Install fence	lin ft	100	1.00	100.00	100	100	100	100	400	
6	Install gate	ea	1	100.00	100.00	100	100	100	100	400	
7	Install light	ea	1	100.00	100.00	100	100	100	100	400	
8	Install sign	ea	1	100.00	100.00	100	100	100	100	400	
9	Install mailbox	ea	1	100.00	100.00	100	100	100	100	400	
10	Install door	ea	1	100.00	100.00	100	100	100	100	400	
11	Install window	ea	1	100.00	100.00	100	100	100	100	400	
12	Install roof	sq ft	100	1.00	100.00	100	100	100	100	400	
13	Install siding	sq ft	100	1.00	100.00	100	100	100	100	400	
14	Install trim	lin ft	100	1.00	100.00	100	100	100	100	400	
15	Install hardware	ea	100	1.00	100.00	100	100	100	100	400	
16	Install paint	gal	100	1.00	100.00	100	100	100	100	400	
17	Install stain	gal	100	1.00	100.00	100	100	100	100	400	
18	Install sealant	lb	100	1.00	100.00	100	100	100	100	400	
19	Install adhesive	lb	100	1.00	100.00	100	100	100	100	400	
20	Install fastener	ea	100	1.00	100.00	100	100	100	100	400	
21	Install nail	ea	100	1.00	100.00	100	100	100	100	400	
22	Install screw	ea	100	1.00	100.00	100	100	100	100	400	
23	Install bolt	ea	100	1.00	100.00	100	100	100	100	400	
24	Install nut	ea	100	1.00	100.00	100	100	100	100	400	
25	Install washer	ea	100	1.00	100.00	100	100	100	100	400	
26	Install plate	ea	100	1.00	100.00	100	100	100	100	400	
27	Install bracket	ea	100	1.00	100.00	100	100	100	100	400	
28	Install support	ea	100	1.00	100.00	100	100	100	100	400	
29	Install anchor	ea	100	1.00	100.00	100	100	100	100	400	
30	Install post	ea	100	1.00	100.00	100	100	100	100	400	
31	Install rail	lin ft	100	1.00	100.00	100	100	100	100	400	
32	Install baluster	ea	100	1.00	100.00	100	100	100	100	400	
33	Install cap	ea	100	1.00	100.00	100	100	100	100	400	
34	Install finial	ea	100	1.00	100.00	100	100	100	100	400	
35	Install ornament	ea	100	1.00	100.00	100	100	100	100	400	
36	Install scroll	ea	100	1.00	100.00	100	100	100	100	400	
37	Install fin	ea	100	1.00	100.00	100	100	100	100	400	
38	Install finial	ea	100	1.00	100.00	100	100	100	100	400	
39	Install ornament	ea	100	1.00	100.00	100	100	100	100	400	
40	Install scroll	ea	100	1.00	100.00	100	100	100	100	400	
41	Install fin	ea	100	1.00	100.00	100	100	100	100	400	
42	Install finial	ea	100	1.00	100.00	100	100	100	100	400	
43	Install ornament	ea	100	1.00	100.00	100	100	100	100	400	
44	Install scroll	ea	100	1.00	100.00	100	100	100	100	400	
45	Install fin	ea	100	1.00	100.00	100	100	100	100	400	
46	Install finial	ea	100	1.00	100.00	100	100	100	100	400	
47	Install ornament	ea	100	1.00	100.00	100	100	100	100	400	
48	Install scroll	ea	100	1.00	100.00	100	100	100	100	400	
49	Install fin	ea	100	1.00	100.00	100	100	100	100	400	
50	Install finial	ea	100	1.00	100.00	100	100	100	100	400	

APPROVED FOR FUNDING BY THE BOARD OF DIRECTORS
DATE OF APPROVAL: 10/10/10

Area (acres)					Development Magnitude						Population (Persons)		
					Residential dwelling units			Nonresidential sq. ft. (1,000 sf)					
	SPECIFIC PLANS												
	McNaughton	1,877.0	0.0	1,877.0	8,000	0	8,000	835.2	0.0	835.2	24,320	0	24,320
	Brandenburg/Butters	348.5	0.0	348.5	1,481	0	1,481	668.3	0.0	668.3	4,502	0	4,502
	Lusardi (Rancho Coachella Vineyards)	260.0	0.0	260.0	1,085	0	1,085	326.6	0.0	326.6	3,298	0	3,298
	Rancho La Quinta	0.0	825.6	825.6	0	2,064	2,064	0.0	0.0	0.0	0	6,275	6,275
	Promenade	335.0	457.0	792.0	2,720	2,000	4,720	209.3	424.9	634.2	8,269	6,080	14,349
	Thermal Airport Master Plan	0.0	2,273.1	2,273.1	0	0	0	0.0	3,765.7	3,765.7	0	0	0
	TOTALS	13,172.4	40,356.8	53,529.2	31,037	19,460	50,497	25,843.7	35,518.0	61,361.7	94,352	59,158	153,510

Table Assumptions

- Incorporated/unincorporated statistics based upon incorporated City area as of March 1996
- Dwelling unit, square footage and population figures presented above illustrate a "credible worst case" buildout scenario but are not intended to set quotas or otherwise limit future development
- Dwelling unit projections assume an adjustment of vacant acreage to account for streets, easements, and lotting inefficiencies as follows: 28% (RVL), 33% (RL, RM, CG, CE), 24% (RH, RVH)
- RVL category assumes no development on slopes over 15% (approx. 640 acres) or transmission power line rights-of-way (approx. 86 acres)
- Square footage projections assume a 32% adjustment of vacant acreage to account for streets, easements, and lotting inefficiencies in all nonresidential categories
- Specific Plan acreage, dwelling unit, and square footage statistics are based upon approved specific plan documents
- Thermal Airport acreage and square footage statistics are based on approved master plan excluding general aviation and cargo related facilities
- Population projections assume a socioeconomic makeup similar to Indio using an average household of 3.2 persons (Indio - 1990 Census) and a 5% vacancy rate

Source: Smith, Peroni & Fox

Figure 18
Circulation Policy Diagram

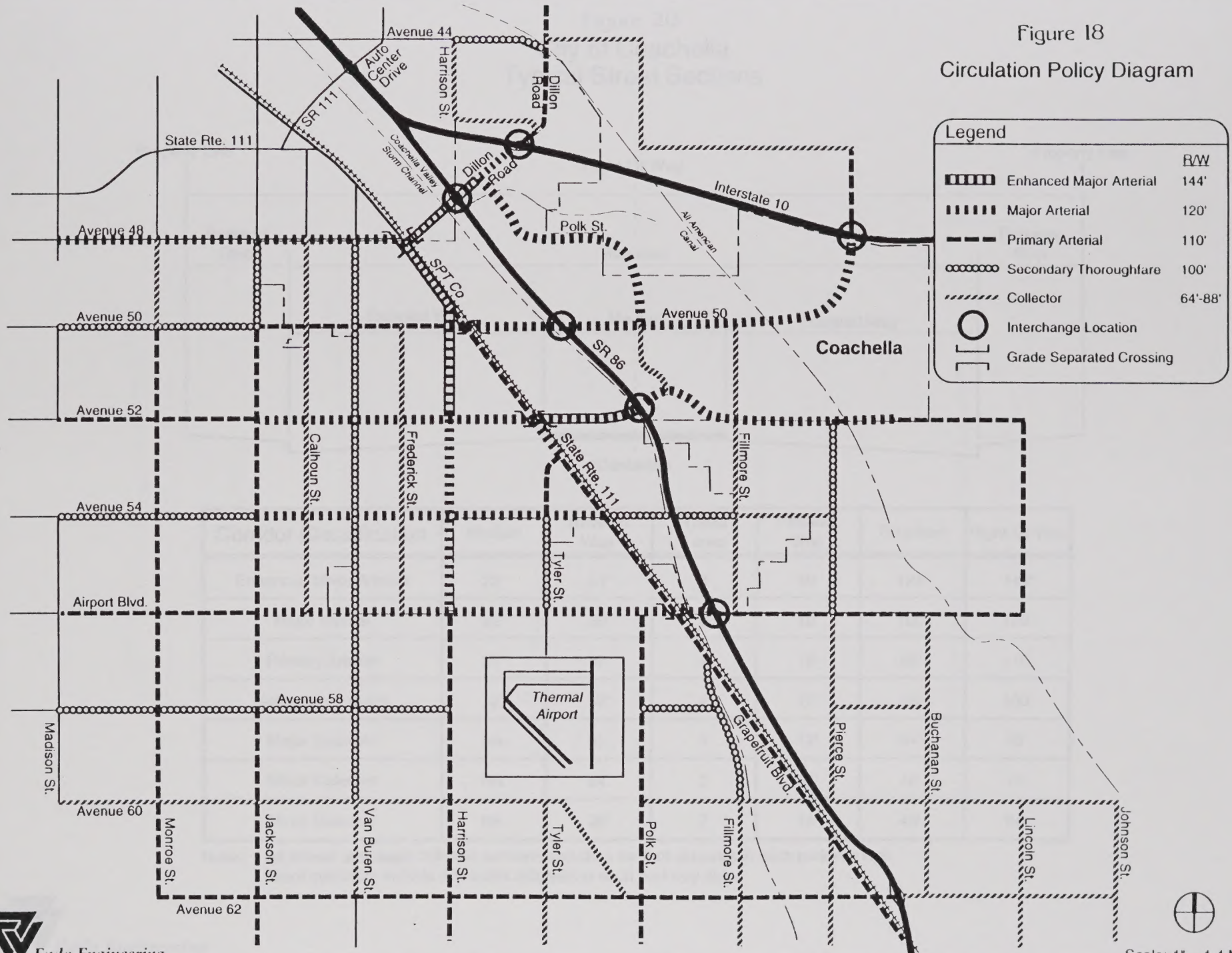
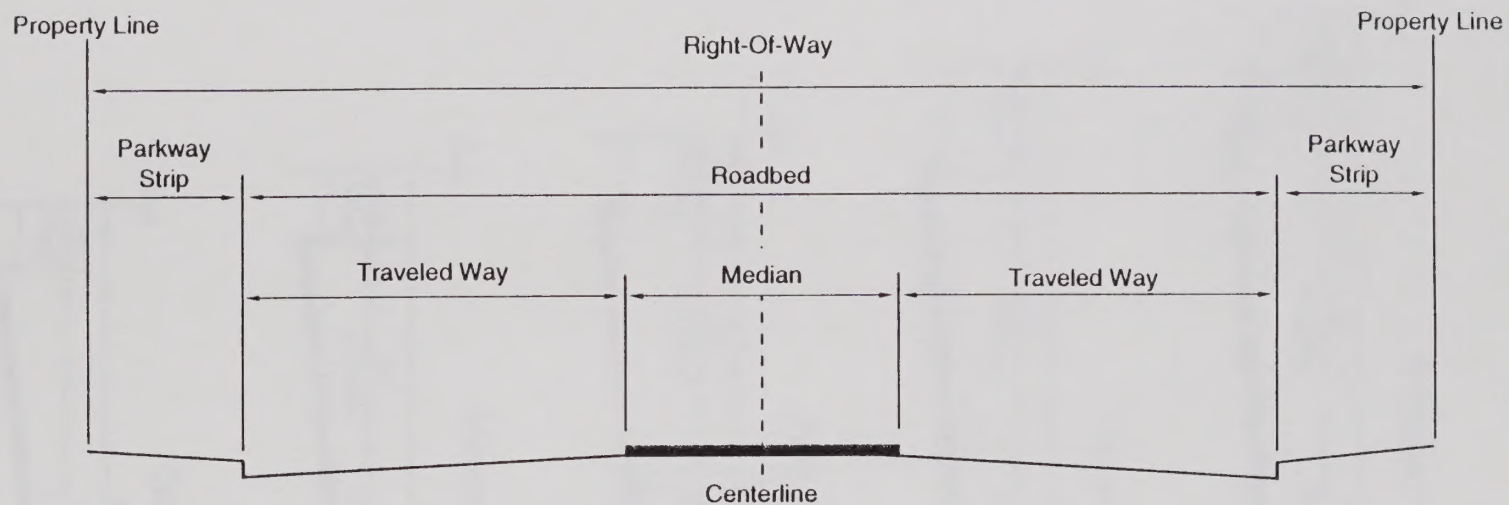




Figure 20
City of Coachella
Typical Street Sections



Corridor Classification	Median	Traveled Way	Travel Lanes	Parkway Strip	Roadbed	Right-Of-Way
Enhanced Major Arterial	22'	51'	8	10'	124'	144'
Major Arterial	22'	39'	6	10'	100'	120'
Primary Arterial	22'	32'	4	12'	86'	110'
Secondary Arterial	12'	32'	4	12'	76'	100'
Major Collector	NA	32'	4	12'	64'	88'
Minor Collector	NA	24'	2	12'	48'	72'
Minor Collector	NA	20'	2	12'	40'	64'

Notes: All arterial and major collector sections include a six-foot sidewalk in each parkway strip.
Minor collectors include a five-foot sidewalk in each parkway strip.



Table 1. Summary of the results of the analysis of variance for the different parameters of the different groups.

Group	Mean	SD	F	p	df
Group 1	100	10	1.0	0.31	100
Group 2	100	10	1.0	0.31	100
Group 3	100	10	1.0	0.31	100
Group 4	100	10	1.0	0.31	100
Group 5	100	10	1.0	0.31	100
Group 6	100	10	1.0	0.31	100
Group 7	100	10	1.0	0.31	100
Group 8	100	10	1.0	0.31	100
Group 9	100	10	1.0	0.31	100
Group 10	100	10	1.0	0.31	100

Table 1

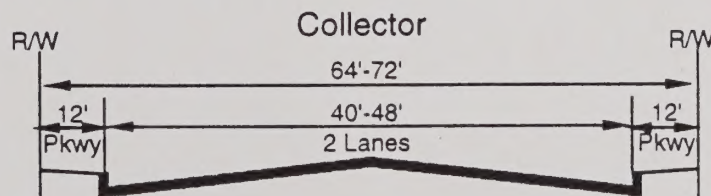
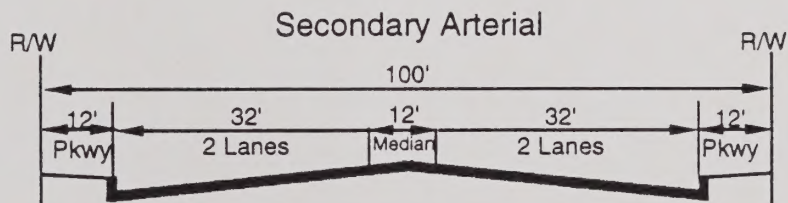
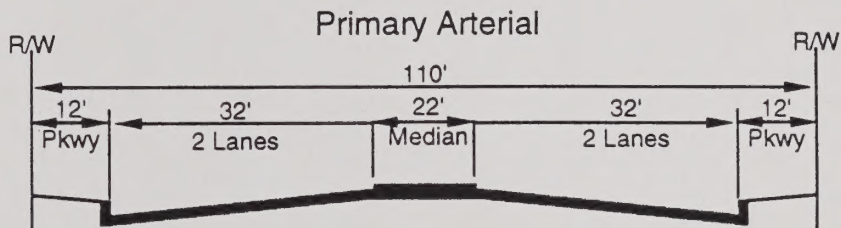
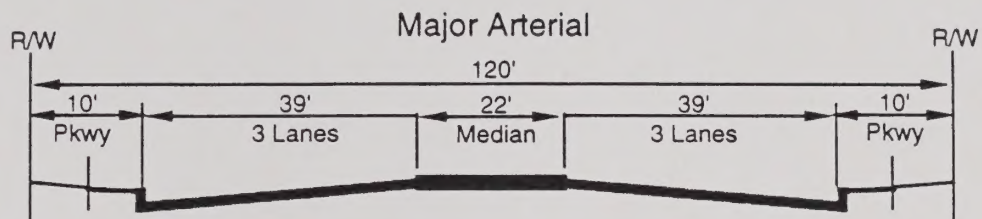
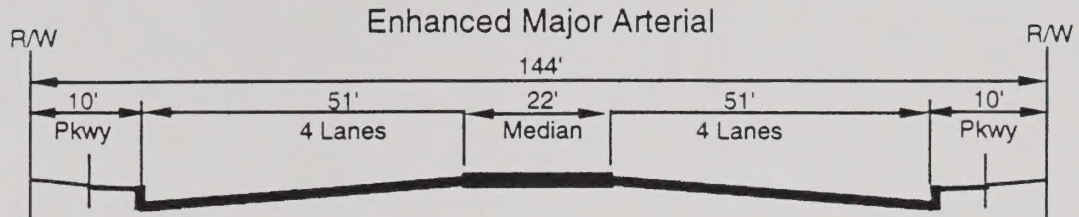


Figure 1

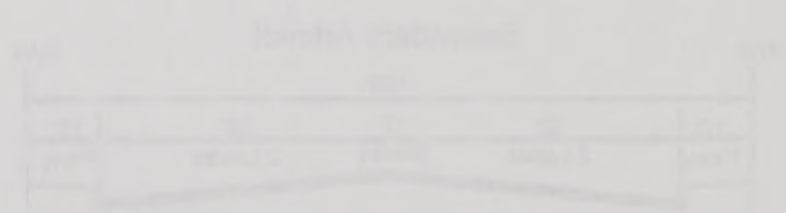
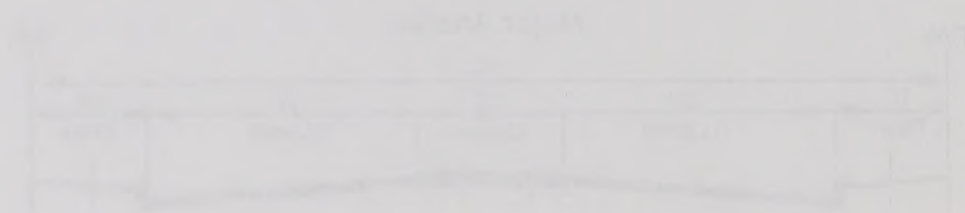
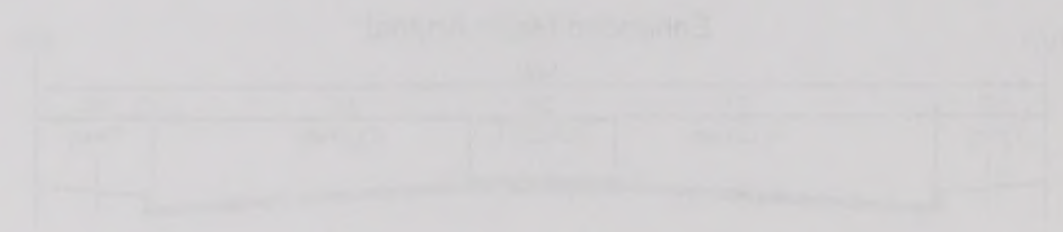
Table 2. Summary of the results of the analysis of variance for the different parameters of the different groups.

Group	Mean	SD	F	p	df
Group 1	100	10	1.0	0.31	100
Group 2	100	10	1.0	0.31	100
Group 3	100	10	1.0	0.31	100
Group 4	100	10	1.0	0.31	100
Group 5	100	10	1.0	0.31	100
Group 6	100	10	1.0	0.31	100
Group 7	100	10	1.0	0.31	100
Group 8	100	10	1.0	0.31	100
Group 9	100	10	1.0	0.31	100
Group 10	100	10	1.0	0.31	100

City of Coachella Typical Street Sections



Typical Street Section



B. Seismic and Geologic Technical
Appendix to the Safety Element

Steven C. Suitt and Associates

*Consulting Engineering, Mining and Environmental Geologists,
Hydrogeologists and Earth Science Professionals*

Seismic and Geologic Technical Appendix to the Safety Element of the City of Coachella General Plan Update 2020

Prepared For:

**City of Coachella
1515 Sixth Street
Coachella, California 92236**

**Susan Williams
Director of Community Development**

Prepared By:

**Steven C. Suitt and Associates
Consulting Engineering, Mining and Environmental Geologists,
Hydrogeologists and Earth Science Professionals**

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Canyon Lake, California 92587
(909) 244-6447 Fax (909) 244-6047**

**June 1996
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Seismic and Geologic Technical Appendix to the Safety Element of the Coachella General Plan Update 2020

Executive Summary

Introduction. An extensive environmental analysis was performed to prepare this Seismic and Geologic Technical Appendix report, which addresses the implications of the geotechnical and seismic hazards within the approximately 84 square mile Coachella General Plan Area. This document is also anticipated to serve as the geotechnical background report for the General Plan Safety Element. Included in this report is a preliminary review of seismic hazards in regards to regional and localized flooding, fires, hazardous materials incidents, and disruption to lifelines systems and critical facilities. The research effort for this Seismic and Geologic Technical Appendix was extensive, with over 280 references including World Wide Web seismic safety information for southern California. Local geologic and geotechnical regulatory and government agency personnel were also interviewed for background information. Finally, the Seismic and Geologic Technical Appendix contains a rather complete and exhaustive interpretation of the geologic and physiographic formation of the region, which has not been previously published in a complete form.

In general, this Seismic and Geologic Technical Appendix is divided into five sections with references located in the appendix. Section 1.0 depicts the statutory requirements for the Safety Element along with suggested goals. The methodology, scope of study, and Steven C. Suitt and Associates (SCS) personnel who performed portions of this study are also presented. Section 2.0 indicates the comprehensive geologic, soils, groundwater and seismic environment of the Coachella Valley portion of the Plan Area. Section 3.0 shows the potential or existing geologic and seismic hazards, and earthquake-induced flooding, fire hazards, hazardous materials incidences and disruptions to lifelines systems within the Plan Area. Sections 2.0 and 3.0 combined form a major portion of the environmental analysis and impacts to the Plan Area. Section 4.0 includes the impacts and mitigation measures to the Plan Areas' potential or existing geotechnical and seismic hazards, which can be utilized as Plan Policies. Section 5.0 addresses emergency response, preparedness and recovery, and research and safety information systems as presented in "California at Risk, Reducing Earthquake Hazards 1992-1996 as amended in the 1994 Status Report" prepared by the State of California Seismic Safety Commission.

Setting. The geologic history of the Coachella Valley/Salton Trough area is important to understand and consider for planning purposes because there are several direct cause-and-effect relationships between the geologic formation of the region and the resulting seismic and geotechnical hazards. These hazards can be best evaluated by understanding how and why they formed. The geologic forces that produced the mountains and valleys that define the Coachella General Plan Area also produced features that pose hazards to the people living in this area. Many of these hazards can be specifically addressed and evaluated in terms of their impact on future planning in the Coachella Valley area. Knowing why the hazards exist should enable the City of Coachella, as well as the surrounding cities, to take appropriate action to study or mitigate the geotechnical/seismic challenges that face this regional area.

In an overall sense, the current topography and most of the surface rock and soil units within the Coachella General Plan Area were formed as the result of the plate tectonic interaction between the Pacific and the North American plates, which are two major portions of the Earth's surface that are moving past each other along a zone of multiple faults within which the entire Plan Area is situated. Interaction of these two plates is along a series of major faults generally called the San Andreas system. This system includes the specific fault called the San Andreas, but it also includes thousands of other faults that collectively take up some of the motion between these two huge plates within the highly seismic southern California region. By understanding the relationship between the different faults and older fault systems within the General Plan Area, which include pre-San Andreas fault systems, the complexity of the seismic risk concerns and geotechnical hazards should become readily apparent.

Generalized Geologic Overview. The Coachella Valley is situated in the northern portion of the Salton Trough, which is a prominent basin primarily formed by mid-Tertiary extensional tectonics. A large portion of this basin surface is situated below sea level. Detachment faulting associated with this extensional deformation, along with later San Andreas transform faulting formed the Santa Rosa Mountains of the Peninsular Ranges physiographic province west of the General Plan Area and the Orocopia Mountains of the southern Basin and Range province southeast of the Coachella Valley. The Cottonwood and the Little San Bernardino Mountains northeast and north of the General Plan Area show the effects of major San Andreas-related compression that marks the adjacent Transverse ranges province north of San Bernardino and Los Angeles. These mountain ranges are nearly all comprised of Mesozoic and/or Paleozoic granitic, metasedimentary and metavolcanic rocks. Elevations within these ranges generally varies from less than 2,800 feet in the Orocopia Mountains to an average of 4,000 feet along the eastern edge of the Santa Rosa Mountains and portions of the Little San Bernardino Mountains.

Progressive offset along the modern San Andreas strike-slip fault system has, in a general sense, moved the Santa Rosa Mountains from Mexico into their current juxtaposed position relative to the Orocopia Mountains, as well as elevated and exposed the relatively low-lying Indio and Mecca Hills easterly of the city of Coachella downtown area. The Mecca Hills within the Plan Area rise to an elevation of roughly 1,500 feet and are primarily composed of early Quaternary and late Tertiary sedimentary rock units that were at one time buried or situated deep within the Coachella basin or Salton Trough. Sediments derived from erosion of these mountains and low-lying hills, as well as Gulf of California, Colorado River and wind blown deposits have infilled the basin or valley with as much as 12,000 feet of Holocene, Quaternary and Tertiary sedimentary rocks and alluvial material. As late as 300 years ago, the former Lake Cahuilla covered much of the "below sea level" General Plan Area.

Generalized Geotechnical and Seismic Overview. The formation of geologic features, such as hillside landforms and faults, and soil development within the Plan Area has created several geotechnical issues, ranging from expansive, liquefiable and collapsible soils to fault rupture potential and severe ground shaking from earthquakes. Recent and historical infilling of the Coachella Valley with alluvial sediments from the Plan Area margins, along with the prevailing northwesterly wind direction and potential concentrated runoff from slopes exceeding 15% indicates a general concern for erosion and collapsible soils. Lake deposits and fine-grained, wind blown sediment present an expansive soil potential in the southern General Plan Area. Existing and potential slope instability, such as landslides or debris flows, is generally limited to the Mecca Hills and Whitewater River-Coachella Valley stormwater channel, where concentrated water runoff is evident and vegetation is sparse.

Groundwater, from lower and upper aquifers, along with alluvial sediments and anticipated seismicity, presents a regional subsidence concern from lower aquifer withdrawal to potentially liquefiable soils within a majority of the Plan Area.

Fault rupture from the "active" Coachella Valley segment of the San Andreas fault along with easterly associated fault splays, locally called the Painted Canyon, Skeleton Canyon, Indio Hills and Coachella Fan fault zone, indicates a planning concern in the eastern General Plan Area. Portions or extensions of the Painted Canyon, Skeleton Canyon, Indio Hills and Coachella Fan faults have not been included in Alquist-Priolo Earthquake Fault Zones or Riverside County Fault Zones for fault rupture potential studies. Extensions of these faults should be considered as "active", or at a minimum "potentially active" by California Division of Mines and Geology (as modified) criteria.

Strong ground motion in the Plan Area from the San Andreas or nearby faults is a primary geotechnical concern. The last large earthquake on the Coachella Valley segment of the San Andreas fault was approximately 300 years ago. With a recurrence interval of approximately 220 years, a large earthquake on this fault segment of the San Andreas appears to be overdue. Additionally, this fault segment has experienced minor amounts of movement by coseismic slip and aseismic creep from the 1968 Borrego Mountain, 1979 Imperial Valley and 1992 Landers earthquakes. Ground motion from the large earthquake anticipated for this or nearby segments of the San Andreas fault will probably range between 60% to 100% of gravity (0.6g to 1.0g) in the Plan Area, exceeding the current Uniform Building Code design value of 0.4g. Earthquake-induced localized flooding, fire hazards and hazardous materials incidences, and disruption to lifelines and critical facilities should be anticipated for the Plan Area from potential seismicity and fault rupture.

San Andreas Transform System. Although the geologic formation of the Coachella Valley is primarily related to extensional tectonics and detachment fault systems, the current geologic framework is dominated by the San Andreas fault that traverses the eastern portion of the Plan Area. The San Andreas fault system not only shapes the current General Plan hillside area landscape and wind patterns, but exposes geothermal and sand, gravel, clay mineral resources, serves as a groundwater barrier trapping regional water supplies, and is an important educational tool utilized by geologists and earth science researchers worldwide. A summary of the Plan Area would not be complete without a tribute to the opportunities and constraints associated with the San Andreas fault.

Offset along the main strand of the San Andreas fault to produce a devastating earthquake is the most commonly perceived geologic concern to the Coachella Valley area. Actually, the name "San Andreas" is applied to one continuous zone of faulting from the San Francisco area to the Bombay beach area of the Salton Sea. This fault system is a long, very continuous and well studied network of faults that represents the most active portions of the boundary between the Pacific and North American Plates. Indeed, this fault zone represents the visible break at the earth's surface separating two large portions of the earth's outer skin, or lithosphere, which are continually moving past each other. This break is one portion of a global system of earth motions that are powerfully and uniquely exposed within the Coachella region and offer planning concerns but also opportunities. This Seismic and Geologic Technical Appendix report focuses primarily on the risks, much like an owners manual, so that the city planners and surrounding population within the General Plan Area can take appropriate steps to mitigate potential hazards posed by the fault system and its associated effects. However, numerous benefits exist for having this geologic feature situ-

ated within the General Plan Area, and could be very beneficial to the economic future and development of the Salton Trough region. The fault has, in part, produced the "valley" and is responsible for many of the topographic and physical features of the region as well as the soils, mineral and geothermal resources and groundwater aquifers.

The San Andreas fault is now recognized as a major structural break separating a portion of two large fragments of the earth's lithosphere, much like a crack between broken pieces of an eggshell. The crack records the presence of long-term forces that have broken and moved the fragments relative to one another. Offset on the San Andreas fault is significant, so that different geologic units are juxtaposed along much of the length of the fault in California. When the actual dimensions of the fault was first widely recognized in the 1950's, it was estimated that offset was about 300 km across different segments. This amount or length of offset figure has been modified in detail, but is still generally accurate. As an example, the Coachella downtown area, which is situated west of the fault, is moving to the north relative to the eastern side of the fault block. Restoration of the Coachella downtown area to its pre-San Andreas position places the region into modern-day Mexico. Continuous, slow motion of the fault blocks is expressed by sharp pulses of motion, or earthquakes, within the upper portion of the earth's crust. The Coachella area has experienced two such earthquakes over the last several hundred years, and another large event seems to be overdue. Ground motions from this event are the principal seismic risk to the region, and when this event takes place, the entire area will be studied in great detail by earth scientists from all over the world.

In a geologic sense, Coachella has emigrated to the north over a long period of time and represents a precursor to the NAFTA Highway and interchange of cultures and economic dependency. In much the same way as geologists from all around the world come to study the geology of the San Andreas near the Coachella General Plan Area and then return to use this knowledge to better understand many other portions of the earth's surface, the city of Coachella and nearby cities could focus on this "world recognized feature" for its physiography, climate, agriculture, groundwater, seismic issues, business and commerce, electrical power, irrigation, and medical health and hygiene implications. General understanding and world export of these experiences and implications could produce profound economic advantages for the region as well as for other parts of the world. Besides building the economy of the region, an understanding of the fault implications, both positive and negative, could make Coachella and sister cities in the Salton Trough a global resource and teaching center. Global telecommunications make it clearly possible to effectively deliver this expertise to the world.

Specific opportunity and constraint implications of the fault in the General Plan Area becomes evident with a simplistic explanation of the geologic formation of the region as shaped by the San Andreas fault. The San Andreas fault along with pre-San Andreas extensional deformation has produced the mountains, low hills such as Indio, Mecca and Durmid Hills, and surrounding valleys. The orientation of these physiographic or landform features shaped by the San Andreas influences the local climate as well as prevailing wind patterns, and helps to preserve and protect the local geology from weathering. The Santa Rosa and San Jacinto Mountains to the west of the Plan Area generally block coastal rain, making the area more arid than adjacent regions and thus preserving the "world class" fault exposures for viewing. Because the fault has produced a valley or gap, such as the San Gorgonio pass north of the Plan Area, the coastal wind can blow in through the gap producing wind generated power resources in the Palm Springs area. The wind can also bring poor air quality in from the San Bernardino area and wind blown sand hazards. In geologic time,

this wind effect along with the presence of former Lake Cahuilla, has sorted sedimentary or alluvial materials within the valley, with fine grained surficial materials being deposited in the southern Plan Area. This wind aided sorting has helped to influence soil development and agriculture in the Coachella valley. The presence of these fine grained materials combined with the occurrence of shallow groundwater also presents a liquefaction concern in the Plan Area.

Additionally, the physiography has had a major effect on localizing water resources in the region. The water flows regionally to the low areas, flowing from the adjacent mountains into the valley or basin continually created by motion along the San Andreas fault. The Colorado River has flowed in to this same area at times, filling the basin floor and depositing sediments over much of the current region of agricultural development within the Salton Trough. Faults act like groundwater barriers in some regions, localizing groundwater resources. Water flowing through the fault zones and adjacent thin crust with associated "hot rocks" have produced significant geothermal resources in the valley for power, aquaculture and spa tourism. Agricultural interaction of the water with irrigation techniques, salinity and selenium problems have all been greatly impacted by the geologic connection to the San Andreas fault system. The expertise and understanding of these problems and features by the valley residences could enable them to export this wisdom to similar areas such as the Jordan Valley, Turkey, Central Asia, China, Latin America, northern Africa, and the Middle East in general.

The presence of the San Andreas within the limits of the Coachella General Plan Area is a remarkable resource from an education and entertainment perspective as well. Many other people besides geologists would like to "see" the San Andreas, stand on it, dream of a jolt occurring while they are on it, and imagine falling into the earth. While these may be geologic untruths, they are intellectual realities for many people and could represent a tourist draw or motif that could be enhanced. The Mecca Hills are unquestionably one of the world's best natural exposures of real fault features produced by strike-slip faults, so that the "draw" of tourists could be realistically developed and exploited. Geologists from around the world visit the Mecca Hills every year and the area is pictured in hundreds of geologic books and field guides. Much of the remaining sections of the San Andreas system is actually fairly unspectacular as it traverses California, in part because the broken rock has produced low valleys that are covered with soil or urban development.

As development proceeds in the Coachella area, the San Andreas could be highlighted rather than feared or ignored. For example, when subsurface trenching studies are performed to evaluate the extent of faulting within the planned Entertainment Zone, excavated exposures of the fault could be preserved and transformed into a visitors center. Similarly, buildings in the Entertainment Zone could be built with seismometers (smart buildings), different types of foundation support, and lifelines supports that are actual experiments for earthquake safety around the world--attracting research and development funding. Landscaping and recreational water usage plans, including "lined" lakes utilizing shallow groundwater, could be developed to mitigate and monitor the impacts of shallow groundwater withdrawal to reduce liquefaction potential. Aquaculture usage to take advantage of the hot geothermal waters at depth beneath the General Plan Area could be further developed and enhanced for commercial and recreational usage. All of these constraints and opportunities associated with the San Andreas fault in the General Plan Area could then be exported to many other regions of the global community with similar geologic boundaries and physiographic features via telecommunications systems.

A brief summary, not all inclusive, of the geologic, geotechnical and seismic findings presented in this Technical Appendix follows.

Summary of Preliminary Findings

- * In general, the current Plan Area landform was primarily shaped by two fault systems: 1) detachment faults related to mid Tertiary extensional tectonics that formed the Santa Rosa and Orocopia Mountains west and east of the Plan Area and the Coachella Valley basin, and 2) the San Andreas system of transform faults, which includes the Coachella Valley segment of the San Andreas fault and easterly splays. Offsets along these faults produced the surrounding mountains and low lying hills that rim the valley floor or basin. Erosion of these adjacent mountains and hills provided infilling alluvial sediments to form the valley floor.
- * The Coachella Valley basin is comprised of Quaternary to Tertiary consolidated and unconsolidated sedimentary rock units and alluvial materials to a depth of 12,000 feet in the General Plan Area.
- * Remnants of the pre-San Andreas fault system are situated east and west of the General Plan Area in the Orocopia and Santa Rosa Mountains, respectively.
- * The remnants of the former Lake Cahuilla water level can be observed as a "bathtub ring" at the base of the Santa Rosa Mountains east of the Plan Area. This former lake inundated a majority of the Plan Area as recently as 300 years ago.
- * Exposures of the Coachella Valley segment of the San Andreas fault in the Mecca Hills within the Plan Area are termed "world class" by geologists and present a unique geologic asset to the city of Coachella that should be preserved. Additionally, the Coachella Valley segment of the San Andreas fault serves as a groundwater barrier to the Plan Area and provides access to geothermal and other mineral resources.
- * Several Soil Conservation Service (SCS) soil associations occur within the Plan Area. Four soil series/associations occur in the relatively flat lying basin or valley floor, and two soil associations are present in slightly elevated Plan Areas rimming the valley or basin.
- * Both shallow or semiperched and deep ground water aquifers occur in the Plan Area. The lower or deep water aquifer of the Thermal Subarea of the Coachella Valley Groundwater Basin contains significant groundwater resources within the Plan Area. Historical shallow groundwater levels have been generally less than 10 feet below the ground surface in a majority of the Plan Area.
- * Soil series or associations that exhibit a high to very high erosion potential from wind or surface water runoff include the Carsitas/Chuckwalla-Badlands association east of the Coachella Canal, and the Coachella, Myoma and Indio soils located throughout the Plan Area.
- * Based on slope and soil or rock type, there is a moderate to high potential for landslides in the eastern hillside portion of the Plan Area. No landslides of sufficient detail and size, greater than five acres, have been mapped in the Plan Area. Most landslides are anticipated to occur as rockfall from earthquakes or from concentrated surface water runoff in the steep-walled drainages within the Mecca Hills.

- * Subsidence from groundwater withdrawal has not been documented within the Plan Area. However, based on historical overdrafting of the Thermal Subarea aquifer combined with similar hydrogeologic settings in other areas of Riverside and Los Angeles Counties where subsidence has occurred from groundwater withdrawal, there is a moderate to high potential for subsidence in the General Plan Area.
- * Although not well documented, there is a moderate to high potential for the occurrence of collapsible soils within the central and valley "rimming" portion of the Plan Area.
- * According to the Soil Conservation Service, the Imperial and Salton soil series within the Plan area have a low to high expansion potential. These two soils occur primarily in the southern Plan Area. Clayey soils located along the various faults within the Mecca Hills portion of the Plan Area are also inferred to have a moderate expansion potential.
- * Percolation from sewage disposal systems within the Plan Area presents a moderate to high concern for slope instability in the Mecca Hills. Also, there is an increased concern for the secondary effects of seismic hazards, such as liquefaction in the valley floor due to the addition of shallow water percolation to subsurface soils.
- * The Plan Area is located within the highly seismic southern California region. Over 111,000 earthquakes have occurred within a 100 kilometer radius of the Plan Area since 1932. Seismicity from several nearby faults could generate strong ground shaking in the Plan Area.
- * Two earthquakes with magnitudes exceeding M7.0 have occurred in historic time on the San Andreas fault within or in close proximity to the Plan Area. The last large earthquake ($M > 7$) to impact the Plan Area occurred about 1680, or over 300 years ago. The Coachella area in the vicinity of the San Andreas fault appears to be in a "seismic gap." However, considering that the recurrence interval for the Coachella Valley segment of the San Andreas fault is 220 years, a significant or large earthquake on this portion of the fault appears to be overdue.
- * Based on its past earthquake history, the Coachella Valley segment of the San Andreas fault has a $22 \pm 12\%$ (high) probability of suffering a large earthquake of $M \geq 7$ during the next three decades. Additionally, the probability of a large earthquake occurring on the Anza segment of the San Jacinto fault zone, the segment closest to General Plan Area, is considered to be high with a $17 \pm 12\%$ chance of occurring during the next 30 years.
- * Significant ground shaking from earthquakes should be anticipated within the Plan Area. Maximum credible and 100-year probable earthquakes on three faults (San Andreas, San Jacinto, and Elsinore) within or near the Plan Area could result in Peak Horizontal Ground Accelerations of 60 to 100% of gravity (0.6g to 1.0g). These values exceed the current Uniform Building Code Zone IV design values of 40% of gravity (0.4g). Ground motion exceeding 20% of gravity is damaging to most types of structures.
- * Based on anticipated seismicity, the presence of alluvial sediments and shallow or semiperched groundwater to within 50 feet of the ground surface, there is a high generalized liquefaction potential within a majority of the Plan Area. Liquefaction includes differential settlement, sand boils, lateral spreading and lurching type ground failure.

- * Earthquake induced ground settlement should be anticipated in those areas outside of those identified as having liquefaction potential.
- * There is a moderate to high potential for earthquake induced flooding along the canals or stormwater drainage channels in the eastern Plan Area.
- * Presently, the potential for earthquake induced seiche or tsunami flooding is remote.
- * Localized flooding from earthquakes can occur from leaking above ground storage tanks, unbraced fire suppressant sprinkler systems, or sand boils.
- * There is a high to moderate potential for earthquake induced fires within the Plan Area, primarily from damage to natural gas and electrical transmission lines, and chemical spills.
- * There is a high to moderate potential for earthquake induced hazardous materials releases, primarily from pipeline breaks, tank failures, falling containers, and transportation accidents.
- * There is a high to moderate potential for earthquake induced disruption to major lifeline systems such as airports, freeways, railroads, communications, natural gas, water, power and sewage disposal systems, which can disrupt or cause a "ripple" effect to critical facilities. Critical facilities that would be impacted by a causative earthquake include police stations, fire stations, hospitals, emergency operations centers, communications/computer centers, dependent care facilities, day care centers, public and private schools, jails, and convalescent homes. The Plan Area should be prepared to "survive" with little or no outside help for days following a causative event.
- * In general, unreinforced masonry (URM) buildings will pose the greatest threat to public safety during strong ground shaking in the Plan Area. Other potentially hazardous buildings include: buildings with nonbearing URM walls and partitions; nonductile concrete-frame buildings; inadequately designed precast, tiltup construction; multistory buildings with soft-stories; inadequately designed structures with geometrical irregularities, including long spans and irregular shapes; mobile homes; residences not properly secured to their foundations; and, buildings located in areas susceptible to liquefaction and fault rupture.
- * It is anticipated that a large majority of proposed developments within the Plan Area can be safely designed in regards to seismic and geotechnical hazards using the proposed geotechnical mitigation methods presented in Section 4.0. Based on new information gathered after the 1994 Northridge earthquake, it is anticipated that a major upgrade to the seismic provisions of the Uniform Building Code will be implemented at a State and National level by 1997.
- * Minor movement of less than one centimeter has occurred on the Coachella Valley segment of the San Andreas fault from nearby earthquakes. Coseismic slip and/or aseismic creep have occurred on this fault segment from the 1968 Borrego Mountain, 1979 Imperial Valley, and the 1992 Landers earthquakes.

- * Active faults, as defined by the California Division of Mines and Geology (CDMG) and modified herein, for inclusion in Alquist-Priolo fault rupture hazard zones that traverse the Plan Area include the Coachella Valley segment of the San Andreas fault and easterly occurring splays of the San Andreas fault, locally named the Skeleton Canyon fault, Painted Canyon fault, and Indio Hills-Coachella Fan faults zones.
- * Potentially active faults that transect the Plan Area include: 1) the northwesterly extension fault segments of the Painted Canyon and Skeleton Canyon fault systems, and 2) the easterly, northerly and southerly extensions of the Coachella Fan fault zone. These two fault zone extensions are considered segments of the San Andreas fault zone complex in the Planning Area. The above fault segments or faults are not presently zoned for Alquist-Priolo earthquake fault zone studies. However, based on current studies, they should be considered active, or at a minimum potentially active.
- * The Santa Rosa Mountain detachment fault underlies the Plan Area at depth and is considered to be inactive.
- * Previous geologic studies performed for the Coachella Valley indicate a fault at the base of the Santa Rosa Mountains to attempt to explain the "uplift" of the San Jacinto Mountains relative to the adjacent valley. This concealed fault was shown to explain the current rock distributions, which is now interpreted to be related to Miocene detachment faulting developed in pre-San Andreas time. This inferred fault of San Andreas age has been removed from recent publications based on the work performed for this Seismic and Geologic Technical Appendix. Accordingly, this inferred fault does not present a hazard to the Plan Area.

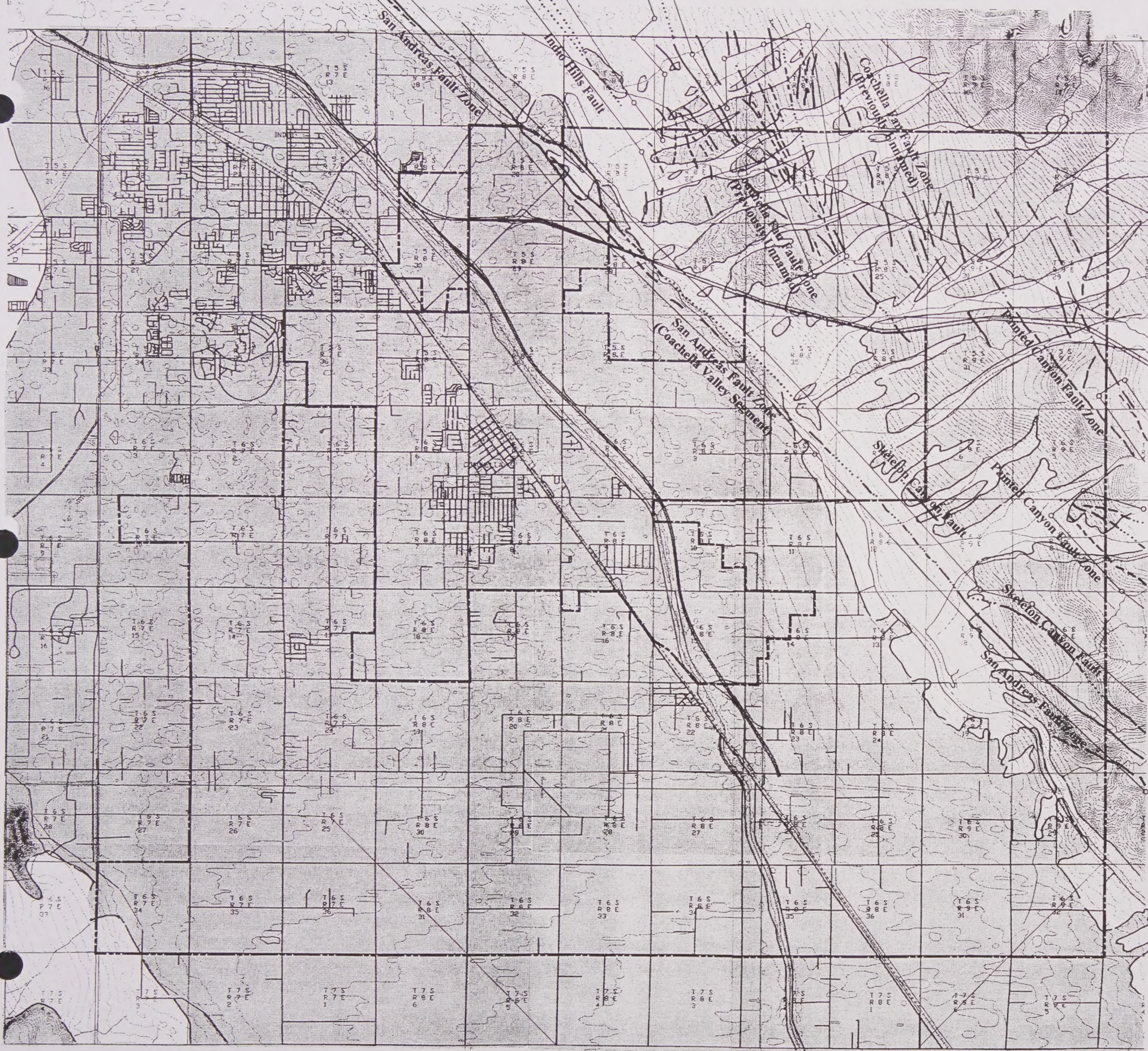
A summary General Plan Area checklist that presents the relative degree of concern for each of the above geotechnical and seismic hazard findings compared to other areas of southern California is depicted in Table 1. Additionally, Figure 1 depicts a summary map of Geotechnical Hazards in the Coachella General Plan Area.

Coachella General Plan

TABLE 1
Summary Checklist of Geotechnical and Seismic Hazards *

CATEGORY	POTENTIAL HAZARD/CONCERN	NONE TO SLIGHT	Relative Degree of Concern			COMMENTS
			LOW	MODERATE	HIGH	
Seismic Hazards	* Fault Ground Rupture/Fissures * Ground Shaking and Acceleration * Liquefaction * Lateral Spreading, Seismic Settlement, and Differential Compaction * Tsunamis * Seiches * Flooding (Pipeline, Aqueduct failure) * Landslides, Rockfall, Unstable Cut and Fill	* *	*	* * * * *	* * * *	
Slope and Foundation Stability, Land Subsidence, Earthworks Construction	* Landslides, Rockfall, Debris Flow, Soil Creep * Expansive Soils * Collapsible Soils * Settlement Potential, Subsidence * Fissuring (Groundwater withdrawal) * Trench Wall Instability * Rippability		* * *	* * * * *	* * *	Undocumented
Erosion, Sedimentation, Flooding	* Erosion Potential, Wind Blown Sand * Alteration of Runoff * Unprotected drainage * Increased Impervious Surfaces		* *	* * *	* *	
Waste Disposal Problems (On Site Sewage Disposal)	* Change in Groundwater Level * Disposal of Excavated Material * Percolation of Earth Material	*		* *	* *	

* Compared to other areas of southern California, as modified from California Division of Mines and Geology Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports.



Explanation

Fault Hazard Symbols

- Active-APEFZ Faults
- Active/Potentially Active Faults

Geotechnical Hazards

- Liquefaction, Landsliding, Expansive Soils, and Wind and Water Erodible Soils Potential.

Coachella General Plan Area

Figure 1

Geotechnical Hazards Summary



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Introduction

Introduction

Section 1.0 Introduction

Seismic and Geologic Technical Appendix to the Safety Element of the City of Coachella General Plan Update 2020

1.1 Introduction

The Safety Element, which includes seismic and geologic hazard related concerns, is only one component of the City of Coachella General Plan Update. In general, the seismic safety portion of this Element should be designed to be consistent with the other Elements of the General Plan, which include Housing, Land Use, Transportation/Circulation, Conservation, Open Space, and oftentimes Noise and Economic Development Elements.

With the serious threat of major earthquakes occurring near or within the Coachella General Plan Area, the Safety Element can become a long range emergency response plan. The principle objective of the Element, therefore, should be to reduce future losses of life, injuries and socioeconomic disruption by design of safer environments and facilities; by avoidance of hazardous sites; by removal or strengthening of unsafe structures; and by promotion of preparedness for emergencies.

The primary concept or purpose of the seismic safety portion of the Element is to provide guidance to the public about (Plan) policies and actions which can produce a safer environment with regards to seismic (earthquakes) and geologic hazards. This includes review of seismically induced flooding and fire hazards that might impact the General Plan Area, and coordination with other Safety Element specialist to adopt preventive and preparedness measures to reduce potential damage. In summary, the threat of natural hazards to the Coachella General Plan Area can not be totally eliminated. The implementation of the Seismic Safety portion of the Safety Element, however, can significantly reduce the magnitude of impacts from a variety of future disasters.

1.2 Statutory Requirements and Background

1.2.1 Statutory Requirements

California Code Section 65302(i) requires each local government to prepare and adopt a Safety Element as a component of their General Plan. In this regard, the general objective of the Safety Element is to reduce death, injuries, property damage, and the economic and social impact resulting from a variety of natural hazards (OPR,1987). This typically involves identifying and mapping natural hazards and the administration of zoning and subdivision regulations that account for the safety hazards. Avoiding loss of life and property can be achieved if the geologic and seismic concern areas within a community are recognized early and if the planning and approval process undertake an orderly means of mitigating potential hazards.

California Government Code Section 65302(g) recognizes that many actions that reduce risk from such hazards as fire, storms, flooding, and landsliding also may result in the reduction of risk from earthquakes. In accordance with the statutory requirements of the Code, the Safety Element must assess threats to the public health and safety from, but not limited to the following:

- * Seismic hazards: ground shaking, surface rupture, and ground failure;
- * Geologic hazards: slope instability, landsliding, and unstable ground;
- * Flood and inundation hazards: tsunamis, seiche, dam failure, and storm induced or other localized flooding;
- * Wildland and urban fire hazards; and,
- * Other safety issues as desired by the community, or suggested in the General Plan Guidelines, including the threat of hazardous materials releases, potentially hazardous buildings, protection of critical facilities, and emergency response issues.

Furthermore, the scope of California Code Section 65302(g) includes an appraisal of fire agency/emergency response safety concerns such as evacuation routes, peak load water requirements, minimum road widths, and clearances around structures.

1.2.2 Background

Seismic Safety issues for the General Plan Area have been partially completed on a local, County and State level. The city of Coachella has adopted a Multihazard Functional Plan to address emergency response issues, the County of Riverside has prepared a Safety Element for the Coachella area dating to 1976 with recent partial updates in 1992, and the Seismic Safety Commission has established goals to improve California's earthquake safety by the year 2000.

Some of these Safety Element concerns, such as emergency preparedness and response issues, have been incorporated into the City of Coachella's Multihazard Functional Plan, which was adopted as Ordinance No. 709 by the City Council on November 4, 1992. The Ordinance was established for the city to provide for the administration of disaster operation and relief in the City of Coachella. In this regard, the declared purposes of this ordinance were to provide for the preparation and carrying out of plans for the protection of persons and property within the city in the event of an emergency (which includes earthquake or seismic related emergencies); the direction of the emergency organization; and the coordination of the emergency functions of the city with all other public agencies, corporations, organizations, and affected private persons.

The existing City of Coachella General Plan adopted the nearly 20 year old Seismic Safety Element developed and implemented by the County of Riverside in 1976. Communications in May of 1994 with Mr. Steve Kupferman, Riverside County Geologist, indicate that due to inadequacies in the existing County document, it was slated for revision in early 1990. Most of the needed changes or updates to this document were required due to amendments to the California State Planning Law (AB 890, Chapter 1255). However, due to County budget constraints, the contract for updating the County Seismic Safety Element was canceled. Thus, the County of Riverside has an incomplete Seismic Safety document.

The State of California has aggressively pursued its goal to significantly improve California's earthquake safety by the year 2000. In this regard, the California Seismic Safety Commission has published several documents to address seismic safety issues, primarily as a direct result of damaging earthquakes. Publications have included the 1991 "California at Risk, Reducing Earthquake Hazards 1992-1996", a "California at Risk" status report prepared

in 1994, and the 1995 "Northridge Earthquake, Turning Loss to Gain" report to Governor Pete Wilson. An agenda of initiatives from the first two reports have been established that will involve several state agencies, local agencies, the private sector, and volunteer groups. The State program includes 42 initiatives in five categories as follows:

1. Addressing the hazards associated with existing vulnerable facilities, including utility and transportation systems as well as buildings;
2. Improving the seismic resistance of new facilities;
3. Improving management of the emergency response and relief efforts;
4. Improving disaster recovery; and,
5. Supporting research and public information and education.

Considering the above important issues have been addressed on a State level, a discussion was not performed for this Seismic and Geologic Technical Appendix report. However, for purposes of clarity, those initiatives that are important to the city of Coachella are presented in Section 5 as reproductions of the original State publications.

1.3 Seismic and Geologic Technical Appendix Section of the Safety Element

The Seismic and Geologic Technical Appendix section of the City of Coachella General Plan Update 2020 Safety Element will primarily focus on two main areas of concern: seismically induced hazards, and geotechnical/geologic type hazards. Other areas that are commonly addressed by the Seismic Safety Commission or addressed in this Seismic and Geologic Technical Appendix in a general geotechnical/geologic cursory review include: flood and inundation hazards; wildland and urban fire hazards; hazardous materials; emergency response, preparedness and recovery; and, research and safety information systems. Based on the above information, the following suggested "Goals" for each of the above sub-elements are submitted for City review.

1) Seismic Hazards

Goal: Minimize injury and loss of life, property damage, and the social, cultural, and economic impacts caused by earthquake hazards.

2) Geologic Hazards

Goal: Protect public safety and minimize the social and economic impacts from geologic hazards.

3) Flood and Inundation Hazards

Goal: Minimize injury, loss of life, property damage, and economic and social disruption caused by flood and inundation hazards.

4) Wildland and Urban Fire Hazards

Goal: Reduce threats to public safety and protect property from wildland and urban fire hazards.

5) Hazardous Materials

Goal: Reduce threats to the public health and safety from hazardous materials, especially threats induced by earthquakes.

6) Emergency Response, Preparedness and Recovery

Goal: Strengthen City of Coachella short-term emergency response and long-term recovery.

7) Research and Safety Information Systems

Goal: Promote research on and mapping of natural and urban hazards; and improve safety information systems for planning, emergency response management and hazard mitigation.

The general objective of this Seismic and Geologic Technical Appendix report is to provide the background technical information and in-depth explanations to support the Safety Element suggested goals (presented above) and policies. Explanation of each geologic and seismic hazard is provided so that building officials, planners, and those responsible for emergency response can promote long-term hazard reduction through prudent land-use planning and proactive, as well as retroactive, regulatory measures. It should be noted, however, that information gathered and presented in this document should not be utilized in lieu of site specific investigations, or for detailed design of future projects.

1.4 Scope of Study

The evaluation of the geologic and seismic environment for preparation of this Technical Appendix report for the Coachella General Plan Area has been accomplished by performing the following scope of work:

- * Review of published maps and reports prepared by the California Division of Mines and Geology (CDMG), U. S. Geological Survey, Association of Engineering Geologists, the U. S. Department of Agriculture Soil Conservation Service, local Geologic Societies (i.e. South Coast Geologic Society, Inland Geologic Society), State University System, Southern California Earthquake Center, World Wide Web communications system, Bureau of Land Management, Bureau of Reclamation, State Department of Water Resources, State Oil and Gas Commission (Geothermal Division), State Seismic Safety Commission, local regulatory agencies or districts (i.e. Water District, Flood Control and Health Services), and several individual consultant reports (unpublished), as summarized in the references included in Appendix B.
- * Review of several other Technical Appendix reports prepared for Safety Elements of General Plans for the city of Malibu, and the Counties of Los Angeles and Riverside.

- * Review of stereoscopic aerial photographs for interpretation of fault, landslide features or other potential fault related features.
- * Reconnaissance level mapping of the General Plan Area at a scale of 1" = 4,000'.
- * Review of the Coachella Valley Association of Governments Master Environmental Assessment (1980), and the Coachella Valley Groundwater Management Plan (1979).
- * Discussions with City Planners, Riverside County Geologist, San Bernardino County Geologist, BLM, CDMG, USGS, California Oil and Gas Commission and Bureau of Reclamation Geologists, other researchers or consultants performing studies in the Coachella Valley, and engineers with the Coachella Valley Water District.

A significant product of the above scope of work was the preparation of reconnaissance level summary geologic, seismic and geologic hazard maps and figures. These maps (4,000 scale) and figures can be utilized for future Specific Plans within the General Plan Area and surrounding or adjacent communities. Also, it is anticipated that the geologic overview presented in Section 2 will be published for use by researchers and consultants working in the Coachella Valley.

The general results of this Seismic and Geologic Technical Appendix is presented in Sections 2 through 5 as follows:

Section 2.0 indicates the comprehensive geologic, soils, groundwater and seismic environment of the Coachella Valley portion of the Plan Area. Section 3.0 shows the potential or existing geologic and seismic hazards, and earthquake-induced flooding, fire hazards, hazardous materials incidences and disruptions to lifelines systems within the Plan Area. Sections 2.0 and 3.0 combined form a major portion of the environmental analysis and impacts to the Plan Area. Section 4.0 includes the impacts and mitigation measures to the Plan Areas' potential or existing geotechnical and seismic hazards, which can be utilized as Plan Policies. Section 5.0 addresses emergency response, preparedness and recovery, and research and safety information systems as presented in "California at Risk, Reducing Earthquake Hazards 1992-1996 as amended in the 1994 Status Report" prepared by the State of California Seismic Safety Commission.

1.5 Personnel

The following Steven C. Suitt and Associates personnel provided technical services on this Seismic and Geologic Technical Appendix prepared for the Coachella General Plan Update 2020 project:

Mr. Steven C. Suitt, Project Manager and Certified Engineering Geologist
Dr. Eric Frost, Project Earth Scientist
Dr. Mark Legg, Project Seismologist
Mr. Michael Hart, Certified Engineering Geologist
Ms. Mitra Fattahipour, Geologic Research Analyst, and
Mr. H. Spencer Knight, Project Soil Scientist.

2. The second part of the document is a list of names and addresses of the members of the committee.

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Section 2

The Geologic and Seismic Environment of Coachella

Section 1
The History and
Evolution of the
Environment

Section 2.0

The Geologic and Seismic Environment of Coachella

2.1 Regional Geology of the Coachella General Plan Area

2.1.1 Topography and Physiography

The Coachella General Plan Area lies within the Salton Trough, which is a prominent basin in southern California along which two major plates of the Earth's surface slide by each other. These two plates, the North American and the Pacific, move past each other along a somewhat diffuse array of faults generally termed the San Andreas fault system (Figure 2). The North American plate, which extends from Coachella to the middle of the Atlantic Ocean, is broken into a series of major physiographic features or ranges, such as the Orocochia and Chocolate Mountains in the vicinity of the Salton Trough. These ranges are of moderate height (less than 2,800 feet high in elevation) and are separated from adjacent ranges by alluvial valleys. This area on the east side of the Salton Trough is generally included in the southern Basin and Range physiographic province, which is marked by alternating basins and ranges formed by fault offsets between ranges. Most of these offsets occurred prior to the development of the modern San Andreas fault system, although San Andreas-related faulting does occur in the southern Basin and Range Province and Mojave desert as suggested by Dokka and Travis (1990), and powerfully shown by the Landers earthquakes of 1992. This overprinting of modern San Andreas faulting on earlier Basin and Range faulting is also evident north and northeast of the General Plan Area, where a coherent group of crystalline rocks form the Cottonwood and Little San Bernardino Mountains. These mountains are composed of granitic bodies and pre-existing metamorphic rocks into the Joshua Tree Monument type granitics intruded. These ranges represent a transition to the large Transverse Ranges physiographic province (San Gabriel and San Bernardino Mountains) of southern California, where the compressional component of San Andreas faulting is strongly displayed.

The eastern edge of the Pacific plate in the area of the Salton Trough is dominated by a coherent slab of rock forming the Peninsular Ranges physiographic province. This set of mountain ranges consists of intermediate composition granitic rocks that have intruded and metamorphosed pre-existing sediments and volcanic rock units. The eastern edge of this province, which forms the western portion of the Salton Trough, has been offset along multiple strands of the San Andreas system, such as the Elsinore and San Jacinto faults (Figures 2 and 3). This gives the western margin of the Salton Trough a somewhat serrated boundary from Palm Springs to Borrego Springs and southerly on to the Mexican border. The Peninsular Ranges are a fairly high (rising to more than 10,000 feet at San Jacinto Peak, with other portions ranging from 6,000 to 7,000 feet in elevation), continuous body of rock that forms a strong, solid beam to the west of the structurally weak rocks of the Salton Trough. The portion of the Peninsular Ranges just west of Coachella is generally referred to as the Santa Rosa Mountains, which rise to elevations greater than 8,000 feet with most of the eastern edge averaging an elevation of over 4,000 feet. They are a continuation of the San Jacinto Mountains south and west of Palm Springs and the Laguna Mountains south of Borrego Springs as shown on the Regional Generalized Geologic Map (Figure 4). All of these "uplifted" ranges are composed of similar rocks, mostly granitic bodies intruding older metamorphic rocks and are the largest geologic unit in southern California.

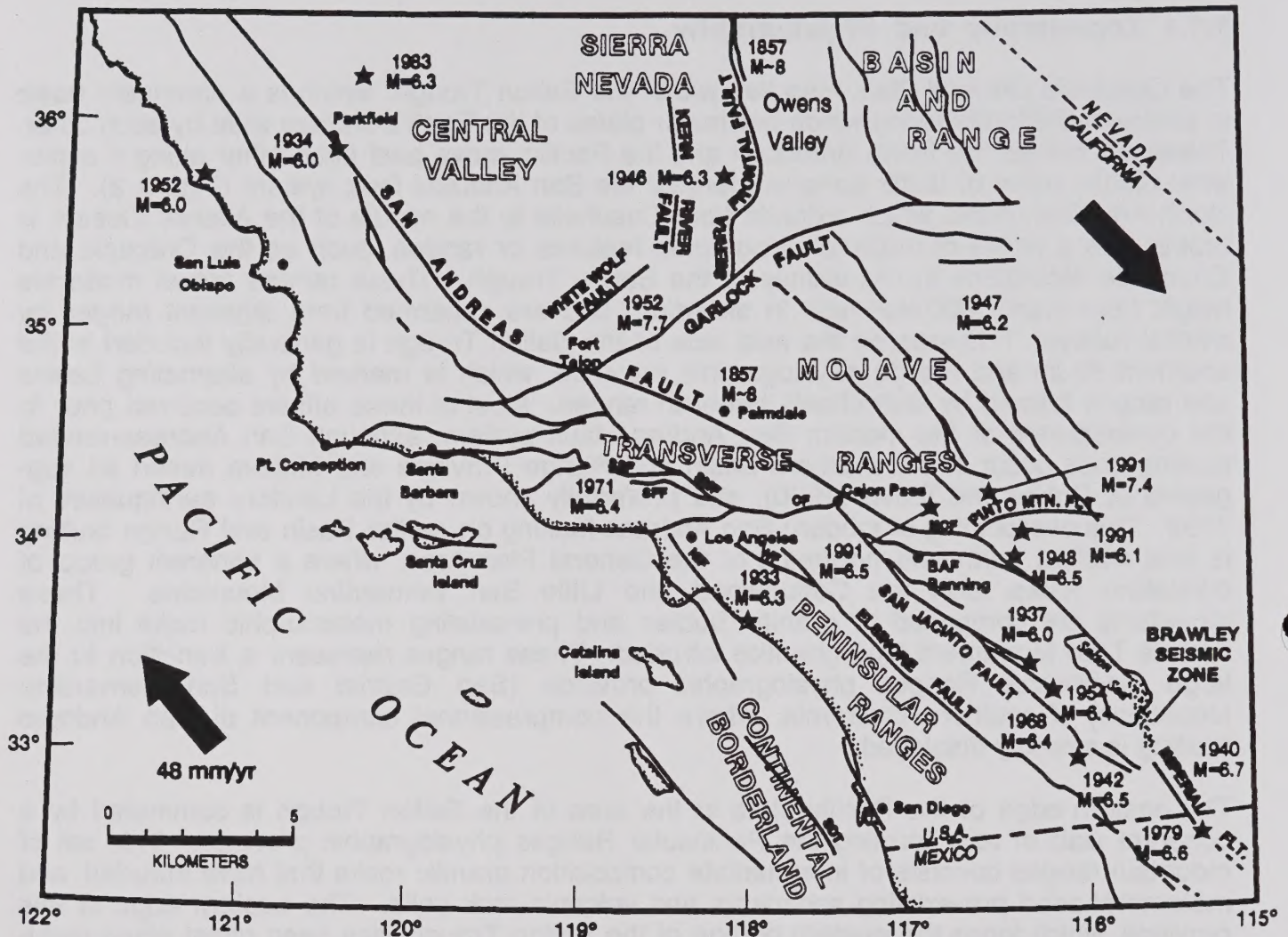


Figure 2. Sketch model of the Salton Trough and surrounding areas separating the North American plate from the Pacific plate. This portion of the San Andreas system separates the southern Basin and Range Province of alternating low ranges and alluvial valleys from the much more rigid and continuous Peninsular Ranges Province. The physiographic form of the southern Basin and Range Province was formed largely in middle Tertiary time, prior to the development of the current San Andreas fault system. Modern-day faulting in the southern Basin and Range Province and the Mojave Desert Province is occurring along faults of the Eastern California shear zone (Dokka and Travis, 1990) just as modern-day faulting is occurring west of the San Andreas along faults such as the San Jacinto, Elsinore, and Imperial faults. The Peninsular Ranges are a strong, coherent block of mostly granitic rocks in the upper crust in contrast to the much weaker rocks of the Salton Trough region and the California Continental Borderland on either side of the Peninsular Ranges. From: Corona (1993).

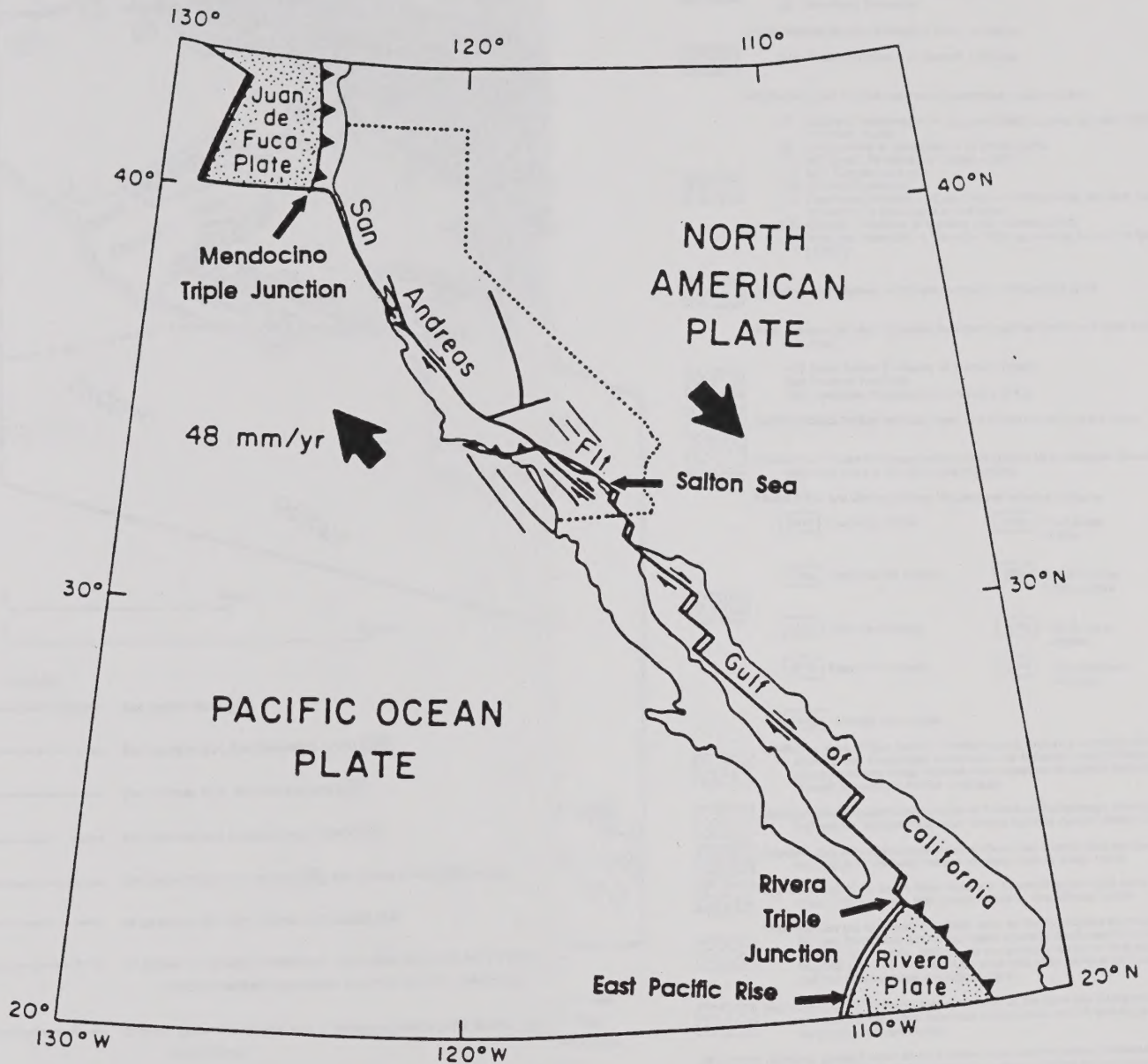
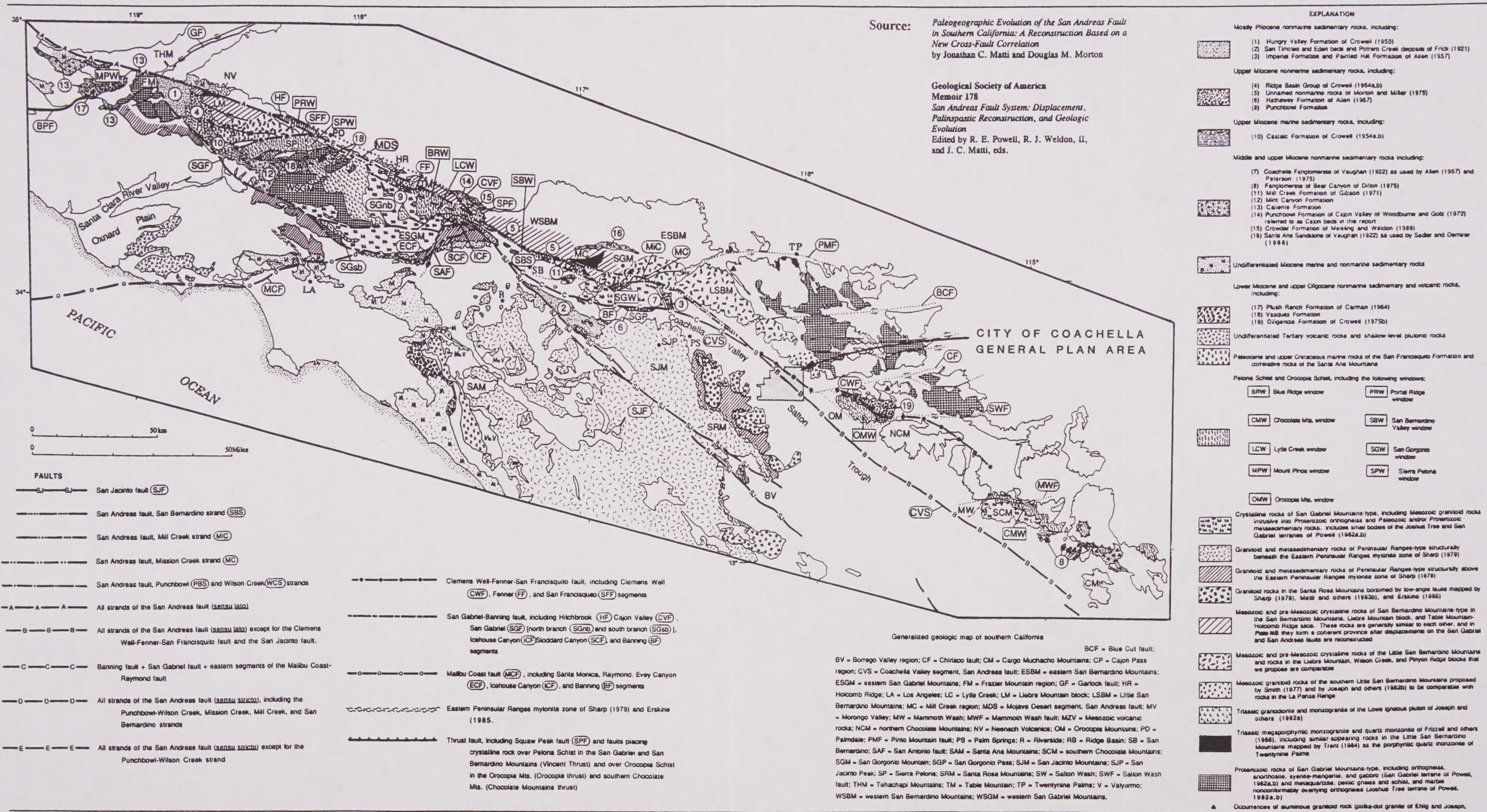


Figure 3. Plate tectonic setting of the Salton Trough area showing the edges of the North American plate and the Pacific plate. The North American plate extends 5100 km (3000 miles) east of the city of Coachella downtown area to the middle of the Atlantic Ocean. The Pacific plate extends 4500 km (2700 miles) west of Coachella to the area near Japan. Motion along the fault is largely horizontal, or strike-slip motion, moving the Pacific plate to the north where it dives beneath Alaska along the Aleutian Islands subduction zone. Large arrows show the relative motion of the North American plate with respect to the Pacific plate. Motion is much like that of a broken windshield of a car, where offset is spread out between hundreds of small breaks rather than being focused on one discrete fault surface. Many small spreading ridges within the Gulf of California show the pattern of en echelon rifting that extends into and beneath the Salton Trough, where sediments have largely filled in and hidden the rift zones and extensional bends in the faults. Hutton and others, 1991.



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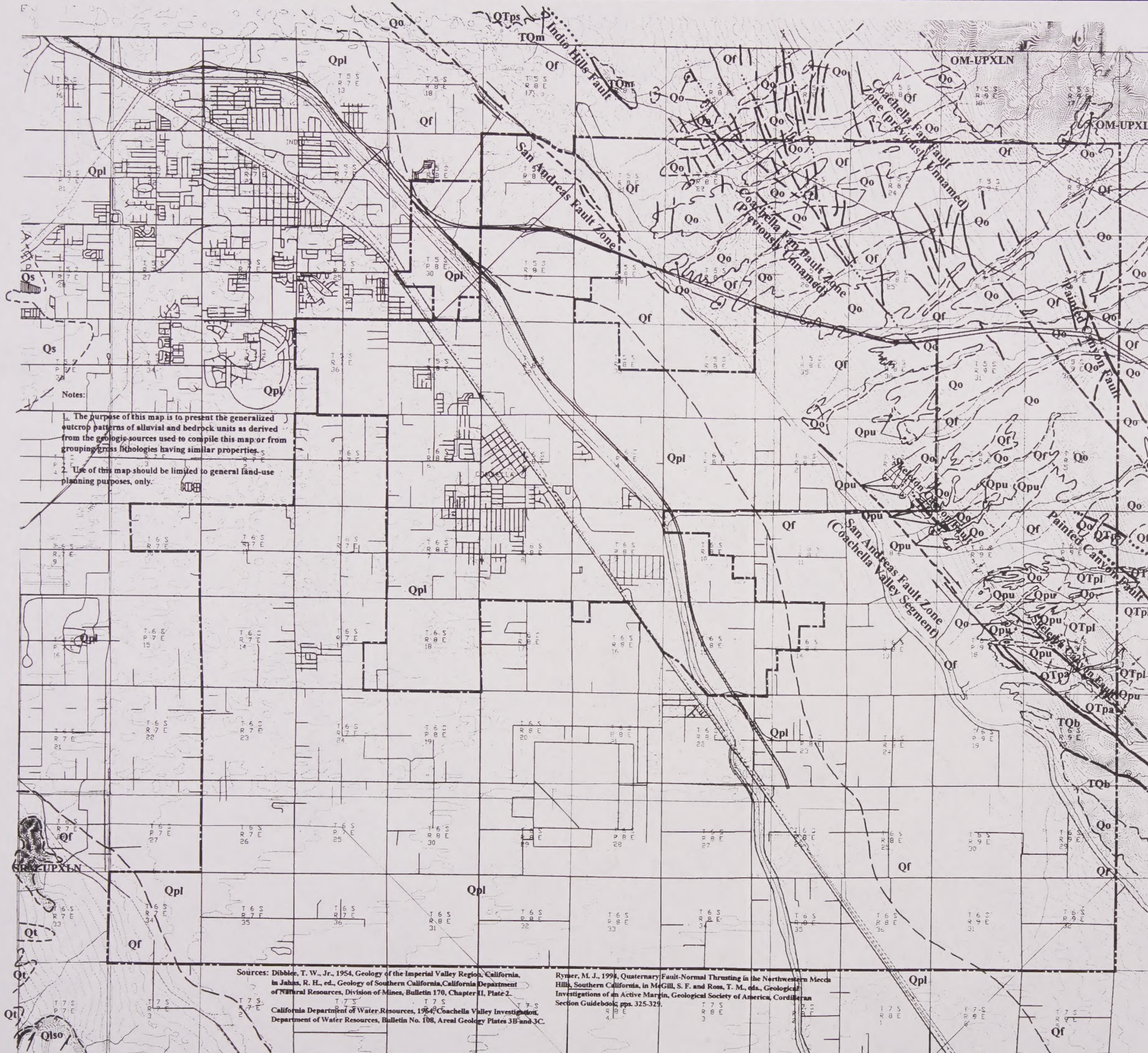
Coachella General Plan Area

Figure 4

Regional Generalized Geologic Map



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CITY OF COACHELLA GENERAL PLAN

EXPLANATION

Geologic Units

- Qs - Dune Sand
- Qf - Alluvial Fan and Stream Deposits within Mountain or Hill Areas
- Qpl - Alluvial Plain and Lake Deposits (includes Active Channel Deposits)
- Qr - Older Alluvial Fan and Terrace Deposits
- Qlso - Landslide Deposits, older
- Qo - Ocotillo Conglomerate
- Qpu - Upper Palm Springs Formation

- Qtpa - Arkosic facies of the Palm Springs Formation
- Qtpl - Lower Palm Springs Formation
- Qtps - Undifferentiated Palm Springs Formation
- Qtb - Borrego Formation
- Qtm - Mecca Formation

- SRM-UPXLN - Upper Plate Crystalline (Granitic) Rocks of the Santa Rosa Mountains Detachment Fault Complex
- OM-UPXLN - Upper Plate Crystalline (Granitic) Rocks of the Orocopia Mountains Detachment Fault Complex

Geologic Symbols

- Contact, Dashed Where Inferred and Questionable
- Fault, Dashed Where Approximately Located, Dotted Where Concealed or Inferred, Arrows Indicate Direction of Relative Lateral Movement
- Anticline, Dashed Where Approximately Located
- Syncline, Dashed Where Approximately Located
- Landslide Areas, Arrows Indicate Direction of Movement

Coachella General Plan Area
Figure 5
Generalized Geologic Map

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Notes:

1. The purpose of this map is to present the generalized outcrop patterns of alluvial and bedrock units as derived from the geologic sources used to compile this map or from grouping areas lithologies having similar properties.
2. Use of this map should be limited to general land-use planning purposes, only.

Sources: Dibblee, T. W., Jr., 1954, Geology of the Imperial Valley Region, California, in Jahns, R. H., ed., Geology of Southern California, California Department of Natural Resources, Division of Mines, Bulletin 170, Chapter II, Plate 2.

California Department of Water Resources, 1964, Coachella Valley Investigation, Department of Water Resources, Bulletin No. 108, Areal Geology Plates 3B and 3C.

Rymer, M. J., 1994, Quaternary Fault-Normal Thrusting in the Northwestern Mecca Hills, Southern California, in McGill, S. F. and Ross, T. M., eds., Geological Investigations of an Active Margin, Geological Society of America, Cordilleran Section Guidebook, pps. 325-329.



	San Górgonio Pass (Allen, 1957)	Upper Coachella Valley (This report)	Lower Coachella & Imperial Valleys (Dibblee, 1954)
Upper Pleistocene	Cabazon Fangl.	Cabazon Fangl. &/or Ocotillo Congl.	Ocotillo Congl.
Lower Pleistocene	Deformed gravels of Whitewater River	Palm Spring Fm. & Canebrake Congl. &/or Painted Hill Fm.	Palm Spring Fm. & Canebrake Congl.
Upper Pliocene	San Timoteo (?) Fm.		
Middle Pliocene	Painted Hill Fm.		
Lower Pliocene	Imperial Fm. Hathaway Fm.	Imperial Fm.	
Upper Miocene	Coachella Fangl.	Coachella Fangl. &/or Split Mtn. Fm.	Imperial Fm. Mecca Fm. Split Mtn. Fm.

Figure 6. Correlation chart of different lithologic units, or mappable formations, within the general Salton Trough region. Rock units are largely derived from either the adjacent mountain ranges, the Colorado River, or the Gulf of California. Chart shows the interfingering nature of the sediments, produced as alluvial fans from the adjacent mountain highs extended variable distances out into the valley, where fine-grained sediments from the Colorado River and the Gulf of California (principally the Imperial Formation) intermix with the alluvial fans. Changes in the amount of water in the Salton Trough, changes in course of the Colorado River, changes in the fault offsets, and changes in climate all contribute to the variability in the sedimentary record present in the Salton Trough. The trough is thus filled with a very heterogeneous mixture of fine-grained and coarse-grained sediments. These sediments reach thicknesses in excess of 20,000 feet (6.4 km) near the Mexican border (Sylvester and Crowell, 1989). Such young sediments produce a very weak upper crust (due to thinning by extension and high heat flow) in contrast to the much more solid crystalline mountain ranges on either side of the Salton Trough. Specific stratigraphic sections and seismic response of these sediments varies considerably throughout the Salton Trough. Sediment thickness below the Coachella Valley is thought to be about 10,000 feet from gravity measurements and old wells (Sylvester and Crowell, 1989) Figure from (Proctor, 1968).

The Salton Trough area is actually the northern portion of the Gulf of California (Figure 2), the rift basin formed by oblique strike-slip motion between the North American and Pacific plates (Figure 3). Motion of the Baja California Peninsula, and western Alta California land masses away from mainland Mexico and eastern California produced the long, narrow Gulf of California (Figure 3). The Salton Trough is thus the lowland area between two of the major plates of the Earth's surface. Infilling of the Salton Trough lowland during the obliquely separating development of the Salton Trough has produced a thick veneer, or frosting, of sediments filling the valley (Figures 4, 5 and 6), much like erosional and depositional filling of a construction ditch dug in the street by constant infilling of sediments and rainwater. The hard sides of the ditch hold a deposit of debris that has filled it through time, recording the events of water, wind, as well as collapse of the sides of the ditch. On the Generalized Geologic Map of the General Plan area (Figure 5), all the units labeled Quaternary or Tertiary (Qs, Qf, Qpl, Qt, Qlso, Qo, Qpu, QTpa, QTpl, QTps, TQb, and TQm) are part of this sedimentary infilling of the hole forming between the North American and Pacific plates. The Qpl deposit comprised of alluvial plain and lake sediments, in particular, forms the frosting-like covering over nearly the entire project area and overlies the rocks exposed like a cake without frosting on both edges of the Salton Trough.

The Colorado River has been the major contributor of the sediments and debris to fill this Salton Trough "ditch" and thus form the nearly flat to gently sloping, below sea level, basin floor. Sediments washing down the Colorado River were dumped into the narrow marine basin between the North American and Pacific plates and formed a large, fan-shaped delta (Figures 7a and b) that effectively isolated the Salton Trough region from the rest of the Gulf of California. Growth of this Colorado River delta eventually separated the Salton Trough from the ocean and produced a region of interior drainage, which is now evident as the Salton Sea. Areas of such interior drainage have no natural outlet, much like a bathtub that is plugged. Because the water cannot leave except by evaporation, it has formed a land-locked lake and produced fine-grained sediments, or lake beds (Qpl), that cover the surface of much of the Salton Trough region (Figure 8). The very gentle slope of the valley is thus a product of infilling of material from the adjacent rivers and evaporation of the water during the hot summer months. The sediments left by the evaporating lakes are very fine-grained muds (silt and clay) with sands and gravels (fanglomerates) and/or conglomerates along their margins. The different packages of sands and gravels and conglomerates (Ocotillo-Qo; Palm Springs-Qpu, QTpa, and QTpl; Borrego-TQb; and Mecca-TQm Formations) and fine-grained muds (Imperial Formation, and young lake bed deposits-Qpl) have produced a heterogeneous mixture of sediments that fill the Salton Trough.

The Colorado River delta has effectively blocked the ocean waters of the Gulf of California from reaching the Salton Trough. The water north of this natural dam has evaporated leaving a majority of the Salton Trough area below sea level (Figure 7b). From 300 A.D. to about 1600 A.D., a lake called Lake Cahuilla extended over much of the current floor of the Salton Trough. The old shorelines, or boundaries, of this lake are widely seen around the margins of the Salton Trough as a bright white line, much like the rings around a drained, dirty bathtub. This veneer covered up the underlying geology of the Salton Trough like the frosting of a cake covers the identity and character of the underlying cake. This is particularly important because this veneer would cover all faulting that had occurred in the area prior to about 1600 A.D. (Figure 5). More faults exist beneath the veneer than are known from surface outcrop, as reflection seismic lines in the southwestern Salton Trough demonstrate (Wade and Zimdar, 1991).

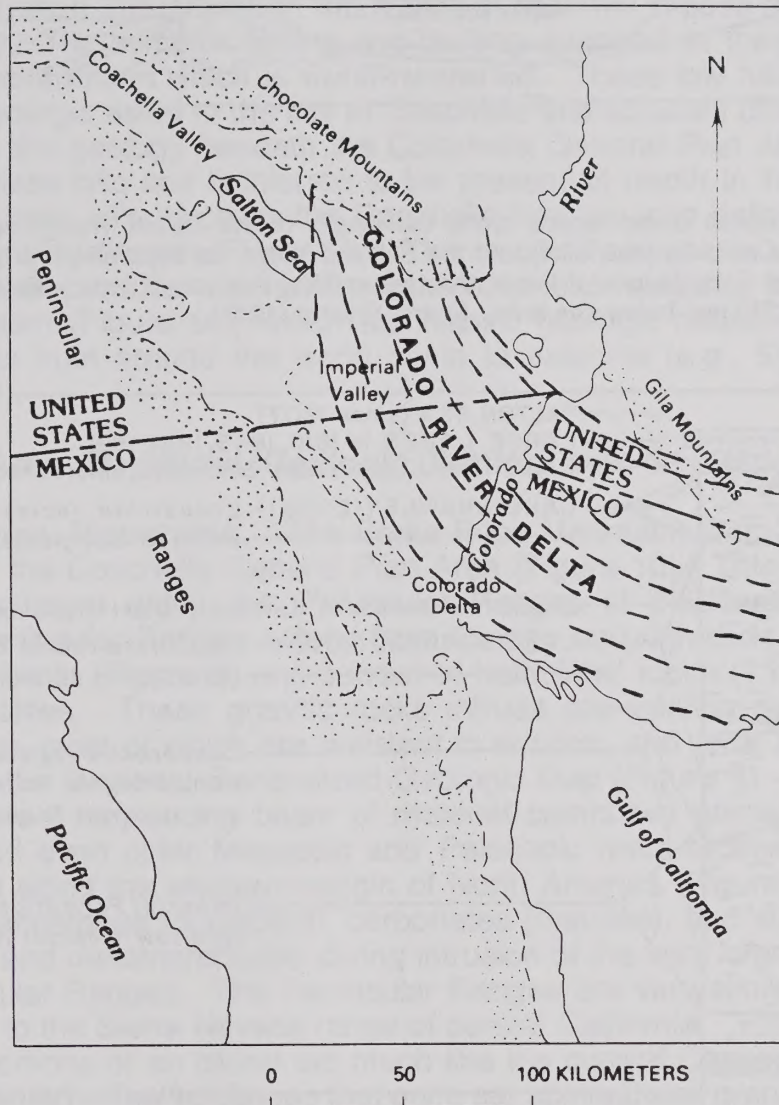


Figure 7a. Index map of the Salton Trough and surrounding areas showing the Colorado River delta infilling the lowland of the Salton Trough and Gulf of California. Sediments deposited into the Gulf of California from the Colorado River built up an enormous fan that eventually formed an alluvial dam extending across the entire valley. The northern portion of the Gulf of California was thus isolated from the main Gulf and its marine sedimentation. This separation of the Salton Trough from the ocean resulted in a change from marine sedimentation (from the Gulf) to terrestrial sedimentation from the adjacent mountain ranges and the Colorado River. Formation of this large delta and damming off of the marine waters allowed the stranded waters of the Salton Trough to evaporate, leaving a broad area lying beneath sea level. Variable filling of the Salton Trough by the Colorado River and major climate changes allowed variable filling of lakes in the Salton Trough. The Salton Trough area is covered with a veneer of these young sediments from the many lakes that have occupied the basin. Figure modified from Fuis and others (1982).

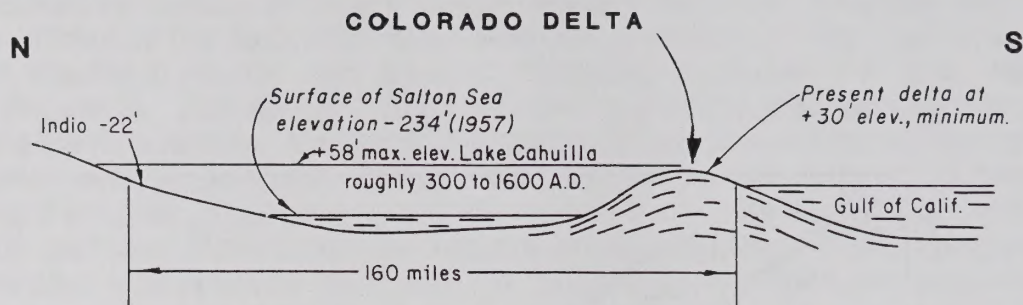


Figure 7b. Sketch cross section along the length of the Salton Trough showing the difference in elevation of the Gulf of California (sea level) and the Salton Trough, as separated by the Colorado River delta. Highest elevation of Lake Cahuilla, one of the historic lakes filling the trough, was +58 feet. Current elevation of the Salton Sea is about 230 feet below sea level. From: Proctor (1968).

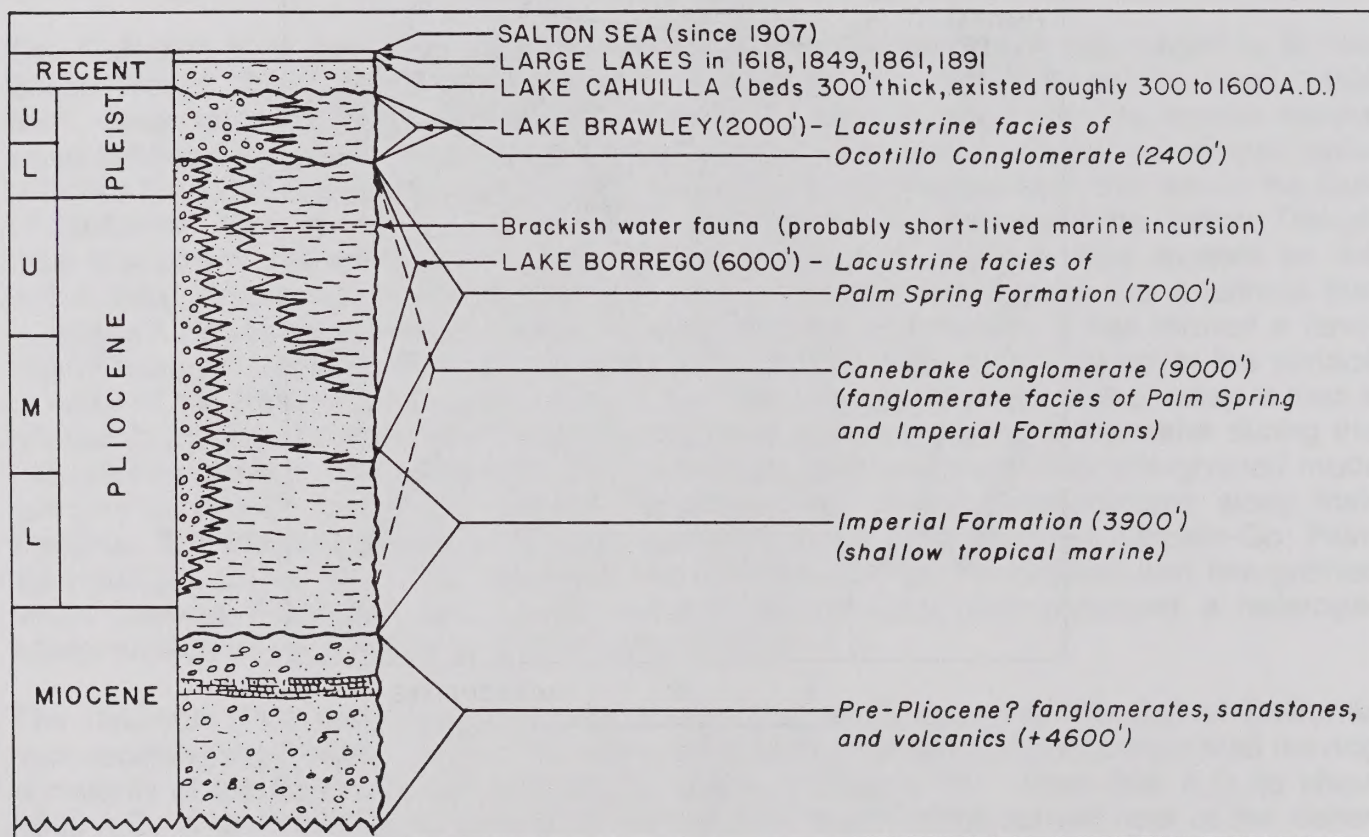


Figure 8. Generalized stratigraphic column for the Salton Trough region highlighting the young lake beds that form a prominent veneer of fine-grained sediments much like a frosting above the thick accumulation of other sediments within the basin. Variability in climate and course of the Colorado River has produced major changes in the size of the lakes and their resulting sediments. These lake-bed sediments interfinger along their margins with coarser fanglomerates derived from the adjacent mountain ranges. This young frosting covers much of the faulting and fault-related deformation of the Salton Trough region prior to the last major high stand of Lake Cahuilla, about 300 years ago. Faults that have not moved during the last 300 years may thus not have any surface exposure, as suggested by some faults imaged in seismic reflection profiles in the Vallecito Mountains area (Wade and Zimdar, 1989). From: Proctor (1968).

Deformation of the sediments that have filled the narrow region between the North American and Pacific plates has produced a series of low hills along the length of the San Andreas fault near the eastern margin of the Salton Trough. The most prominent of these low hills are the Mecca Hills, just east of the town of Mecca, the Indio Hills, just northeast of the city of Indio, and the Durmid Hills east of the Salton Sea (Figure 11). These hills rise to elevations of roughly 1,500 feet in height and expose portions of the inside of the alluvial fill that was deposited into the Salton Trough, much like a slice of cake will expose portions of the interior of the cake to view. The complex folding and faulting exposed in these low, badlands-like hills, forms a unique landform which is world-renowned. These low hills represent a unique topographic and geologic asset to the city of Coachella and adjacent cities. They also represent a window into the geology beneath the Coachella General Plan Area that can be seen at the surface in these hills and is inferred to be present at depth in the intervening areas. Regions between these hills, such as the Coachella fan, are also deformed, by extensional faulting and infilling of sediments (Figure 9b). The small differences in strike or orientation of the San Andreas fault produce alternating restraining and releasing bends within the San Andreas Fault system (Figure 9c), which are classic geologic relationships that geologists and earth scientists from around the world come to examine (e.g., Sylvester and Crowell, 1989; Rymer, 1994).

2.1.2 Planning Area Structural Geologic Setting and Geologic Units

2.1.2.1 Santa Rosa Mountains. The Santa Rosa Mountains form the prominent mountain range west of the Coachella General Plan Area (Figure 10). This name is applied to a portion of a much larger entity, the Peninsular Ranges of Southern California and Baja California. The Peninsular Ranges extend from Orange and Riverside County to the southern tip of Baja California (Figure 3) and consist of batholithic rocks of intermediate composition, primarily tonalites. These granitic rocks intrude pre-existing meta-sedimentary and meta-volcanic rocks, most of which are resistant to erosion, and form a fairly solid block of rock as shown on the Regional Generalized Geologic Map (Figure 4). This block of rock is important in that it is a very strong beam of material composed primarily of old (Mesozoic) granitic rocks, and even older Mesozoic and Paleozoic meta-sedimentary rocks. These older rocks formed along the western margin of North America (Figure 10) and include now metamorphosed sandstones (quartzites), carbonates (marbles), and shales (schist). These rocks were buried and metamorphosed during intrusion of the very large batholithic body that formed the Peninsular Ranges. The Peninsular Ranges are very similar in composition and structural strength to the Sierra Nevada range of central California. The granitic rocks represent the deeper portions of an island arc much like the current Cascade Mountains (Mt. St. Helens and Mt. Rainier). The volcanoes that once sat above these granitic rocks have largely been eroded away except in parts of the coastal California and Baja region. The Santa Rosa Mountains display the roots of these volcanoes. The Deep Canyon area near Palm Desert exposes one of the deepest portions of the Peninsular Ranges known, meaning that this area has been uplifted higher than almost any other part of the entire 1500 km length of the Peninsular Ranges.

The Peninsular Ranges form such a strong beam of rock because they are thick (30 km?), cold, and fairly homogeneous. Additionally, layering is relatively weak within them. As a consequence, the rocks are still quite intact and resist deformation. Old deformational or intrusive features such as ductile shear zones and pluton boundaries can be coherently traced through the entire range (Figure 12). The most prominent ductile shear zone of mylonitic gneiss has been extensively studied within the Santa Rosa Mountains by Lockwood (1961), Sharp (1972, 1979), Theodore (1970), Erskine and Wenk (1985), George

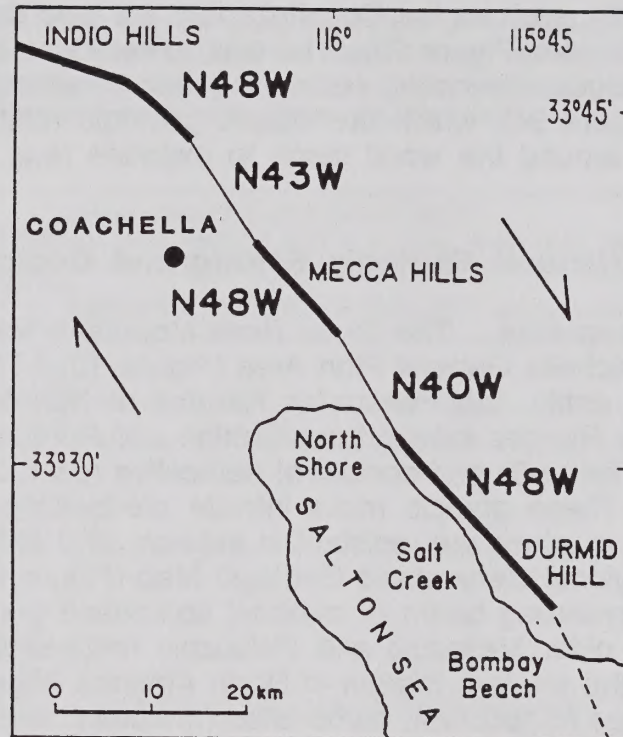
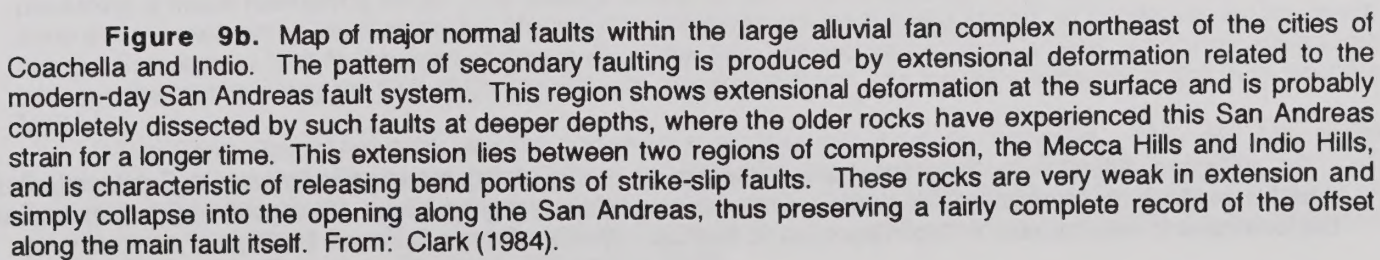


Figure 9a. Slight changes in the strike of the San Andreas fault have produced world-class exposures of deformed sediments that were deposited in the Salton Trough and then deformed by the strike-slip faulting. Where the strike of the San Andreas restrains the motion between the North America and Pacific plates, the areas bow up to form low hills that include the Indio Hills, the Mecca Hills, and the Durmid Hills. Deformation by folding and faulting is intense at these compressional contacts of the two plates, but probably does not extend to the regions between the restraining bends into the releasing bend regions (Figure 7b). Rather, in the releasing bend areas, extensional fault features are variably developed in the sediments, especially in the region between the Mecca Hills and Indio Hills (see Clark, 1984), where prominent extensional faults cover a large area. Modified from Bilham and Williams (1985).



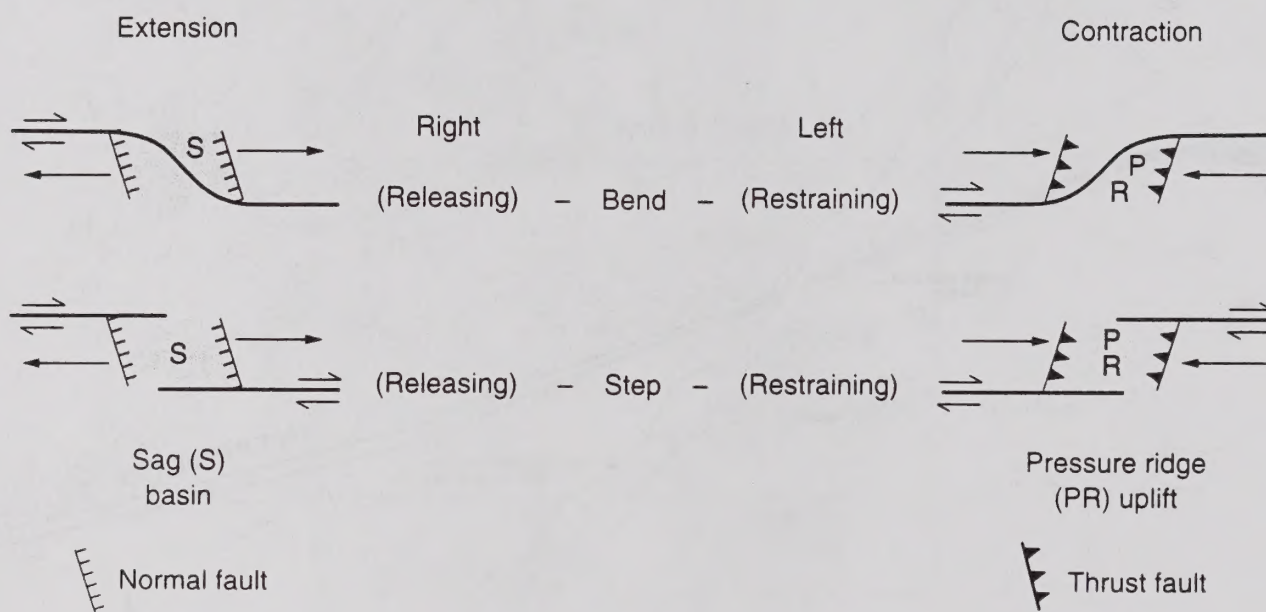


Figure 9c. General diagram showing restraining and releasing bend geometries along strike slip-faults and the resulting compressional hills that developed during offset along the faults. This geometry largely explains the location and development of the Indio, Mecca, and Durmid Hills. From: Sylvester (1988).

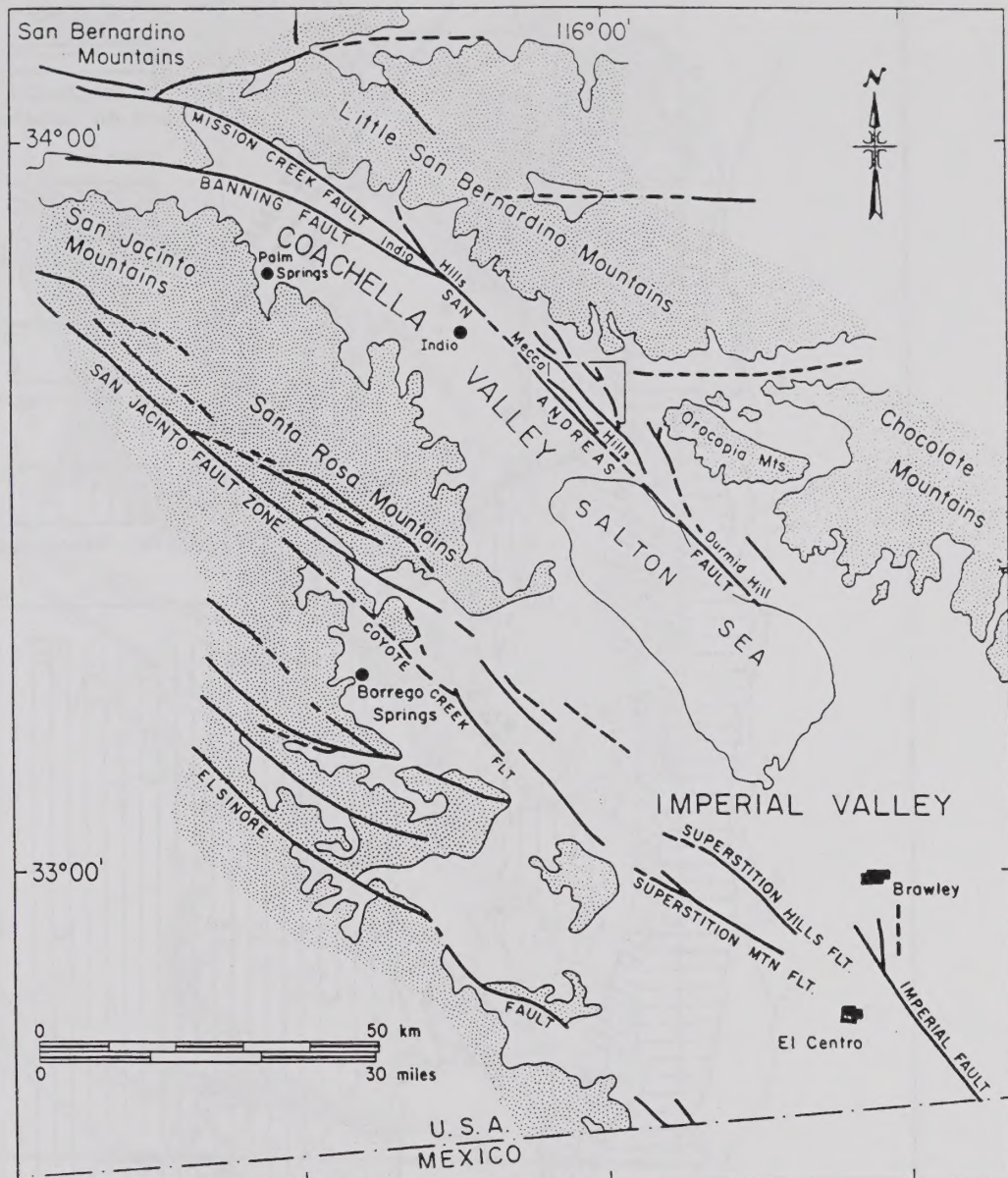


Figure 10. Diagrammatic fault map of the central Peninsular Ranges from the Riverside - San Bernardino County area south to Mexico. San Andreas fault is present east of Coachella and extends to the south to the Bombay Beach area near the southeastern end of the Salton Sea. Here, the motion is transferred along the diffuse Brawley seismic zone to the Imperial fault zone. The Bombay Beach area is thus the southern terminus of the specific fault called the "San Andreas," although the San Andreas system clearly extends south to the Gulf of California along the Imperial, Cerro Prieto and Laguna Salada fault systems.

North of Coachella, the San Andreas bends to the west along the Mission Creek and Banning faults, producing a major restraining bend. The arcuate shape of both the releasing bend along the Brawley seismic zone and the restraining bend along the Mission Creek-Banning faults is being cut off, or truncated, by the nearly straight San Jacinto fault to the west of Coachella. The San Jacinto fault makes a much straighter connection between the motion along the Gulf of California faults and the northern and central segments of the San Andreas fault.

The Santa Rosa Mountains are the prominent mountains just west of Coachella. They are part of the Peninsular Ranges batholith that extends from approximately the intersection of Orange, Riverside and San Bernardino Counties to the south end of Baja California. The edges of this Sierra Nevada-like, rigid block of granitic rocks is serrated by offset on the multiple faults of the San Andreas system, like the San Jacinto and Elsinore faults. Modified from: Sylvester and Smith (1976).

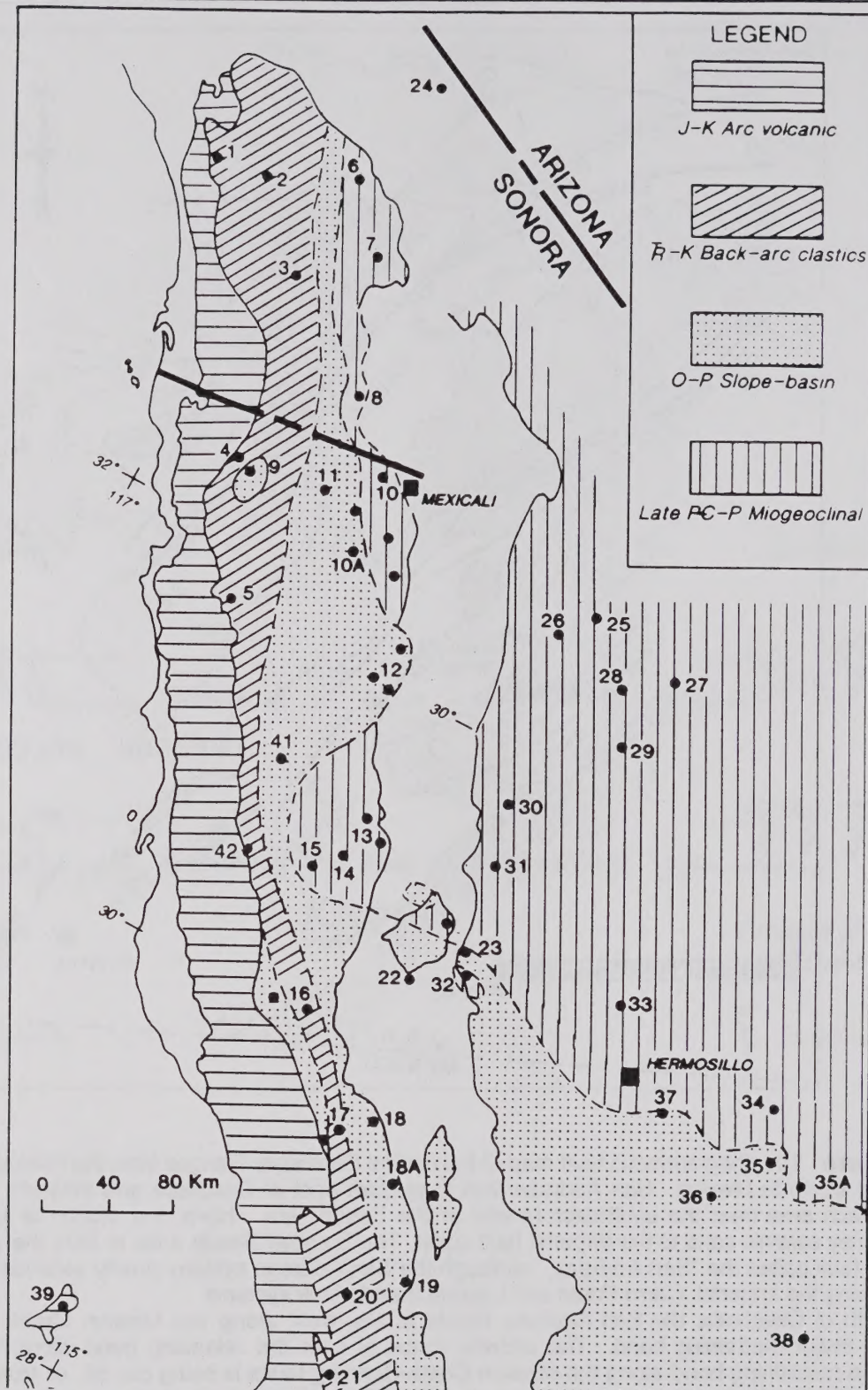


Figure 11. Pre-San Andreas reconstruction of sedimentary and volcanic rock units into which the Peninsular Ranges batholith was intruded. By returning the Peninsular Ranges to the south, stratigraphic sections in Baja California can be brought back into continuity with similar stratigraphic sections in mainland Mexico. Present Arizona-Sonora boundary is shown, as is the present California-Baja California border, which has been moved southward about 280 km. Rocks beneath the Coachella downtown area thus once sat in modern-day Sonora and have been transported northward to their current position. Rocks west of Coachella in the Santa Rosa Mountains are similar to rocks in much of Sonora. From: Gastil (1994).

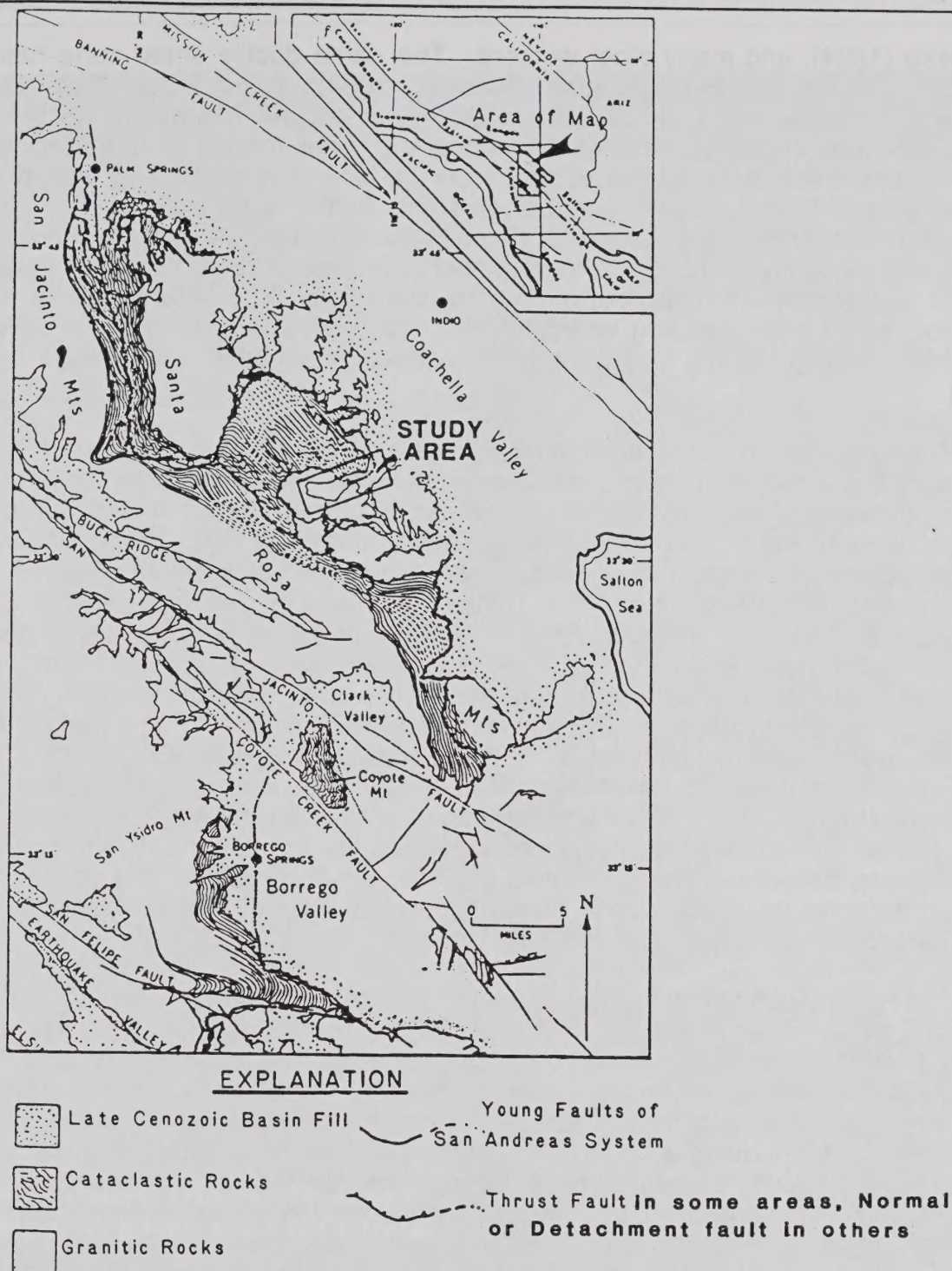


Figure 12. Map showing ductile shear zones of Mesozoic age that undulate through the San Jacinto Mountains, Santa Rosa Mountains, Coyote Mountain, Yaqui Ridge (Borrego Springs area), Whale Peak, and other ranges. This map by Sharp (1979) showed the regional occurrence of a zone of ductile deformation that is intact except for offset on strike-slip faults such as the San Jacinto, Coyote Creek, and other faults. The San Jacinto-Santa Rosa Mountains, in particular, are a coherent block of rock that extends from Palm Springs to Salton City. This range underlies much of the Coachella Valley as well, but is buried by the sediments of the Salton Trough filling in the basin. These rocks are truncated east of Coachella by the San Andreas fault. In part, the upper (eastern) contact of the zone shown on this map as the Mesozoic shear zone is a much younger normal fault, the western Salton Trough detachment fault.

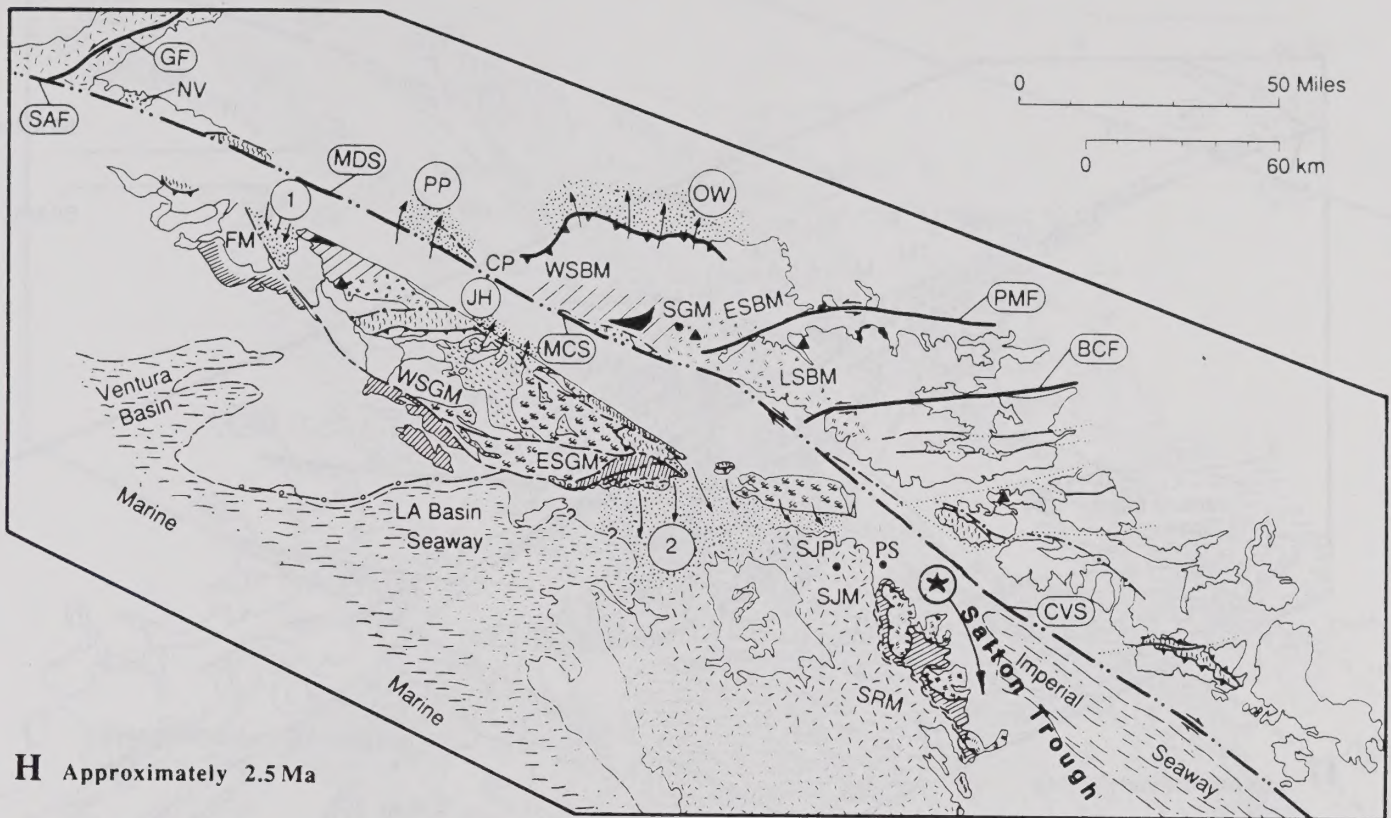
and Dokka (1994), and many other workers. The same ductile shear zone has also been studied in the Borrego Springs area (Simpson, 1984), Yaqui Ridge (Schultejaahn, 1984; Engel and Schultejaahn, 1984; Stinson, 1990), and Laguna Mountains (Girty and others, 1993). This zone of ductile deformation appears to have formed in late Mesozoic time as indicated from fission-track uplift ages that record a time of rapid cooling ending at about 72 Ma (George and Dokka, 1994). Although soft and ductile when they formed deeper in the crust at high temperature and pressure, these mylonitic gneisses form a very strong body of rock once they elevated and cooled in the upper crust like a heated piece of plastic, the plastic is soft and pliable when hot, but quite hard when cold. The boundary between the once ductile rocks and their overlying undeformed rocks has helped localize later deformation by extensional faulting, which in turn helped localize even later deformation by strike-slip faulting.

On the Regional Generalized Geologic Map (Figure 4), this zone of ductile flow is prominently shown west of the project area. Rocks above and below this ductile flow zone are separated from each other by a wavy, somewhat diffuse line (Figure 4). Rocks on the east sit above the ductile zone and were once in a different position with respect to the underlying rocks, although the actual direction of offset is argued by different workers (Erskine and Wenk, 1985; Simpson, 1984; Girty and others, 1993). This zone of granitic rocks that sit above the mylonite zone (Eastern Peninsular Ranges mylonite zone) is itself overlain by similar crystalline rocks that have been offset to the east along an east-dipping major normal fault, termed the Santa Rosa detachment fault, which is part of the much larger Western Salton Sea-Trough detachment system (Frost and others, 1993, 1996). These rocks that sit above the detachment fault are identified as SRM-UPXLN (Upper-Plate Crystalline Rocks of the Santa Rosa Mountains Detachment Fault Complex) on the Generalized Geologic Map of the project area (Figure 5). On the Regional Generalized Geologic Map (Figure 4), portions of this fault in the Santa Rosa Mountains are shown as the boundary between major rock units on the eastern side of the range. These crystalline rock units, as well as the Santa Rosa Mountain detachment fault, extend beneath the Planning Area and form the floor of the Salton Trough on the west side of the San Andreas (Figure 13).

The Santa Rosa Mountains originally formed in an area in what is now northern Mexico and were transported to the north during offset on the San Andreas fault (Figures 11, and 14a through 14e). Little brittle deformation actually affected this solid range during its history of deformation from its time of formation until the present. Offset along the San Andreas system seems to have moved the range rather passively to the north from Mexico. This passive motion is much like moving a large board from one place to another, it can be deformed on the outside, or broken into large pieces, but also moved without obvious distortional deformation because it is so strong. In contrast, the weaker rocks forming the Salton Trough can be highly deformed with far less force involved. A crustal cross section from coastal California to the Chocolate Mountains (Figure 15), drawn using some of the best subsurface data available, shows this striking contrast between the thickness and strength of the rocks of the Peninsular Ranges and those of both the Salton Trough and Chocolate Mountains (North American plate). This difference in strength is extremely important in terms of the depths and sizes of earthquakes that could be generated in this region. The strong rocks of the Peninsular Ranges can generate fairly powerful earthquakes because the rocks are strong and will not move without large forces breaking them. Rocks in portions of the Salton Trough, however, are relatively thin and hot because magma is so close to the surface. The rocks are therefore much weaker and will break with much less force. An analogy would be the differ



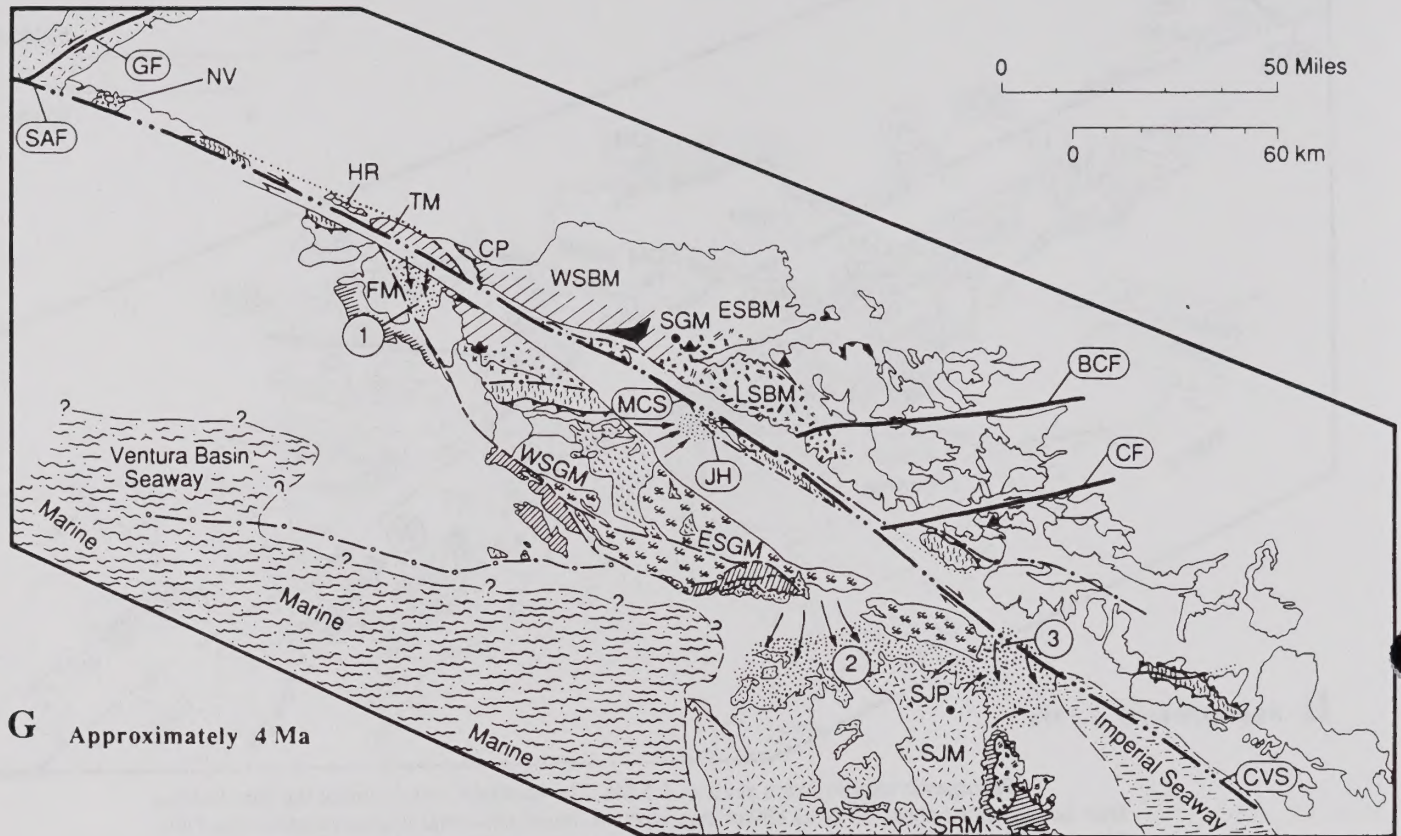
Figure 13. Landsat Thematic Mapper image of the Santa Rosa Mountains with the trace of the Santa Rosa Mountains detachment fault drawn on it. Fault dips gently beneath the Coachella Valley and formed original valley prior to motion along the San Andreas fault system. From: F. Corona, written commun. 1993).



H Approximately 2.5 Ma

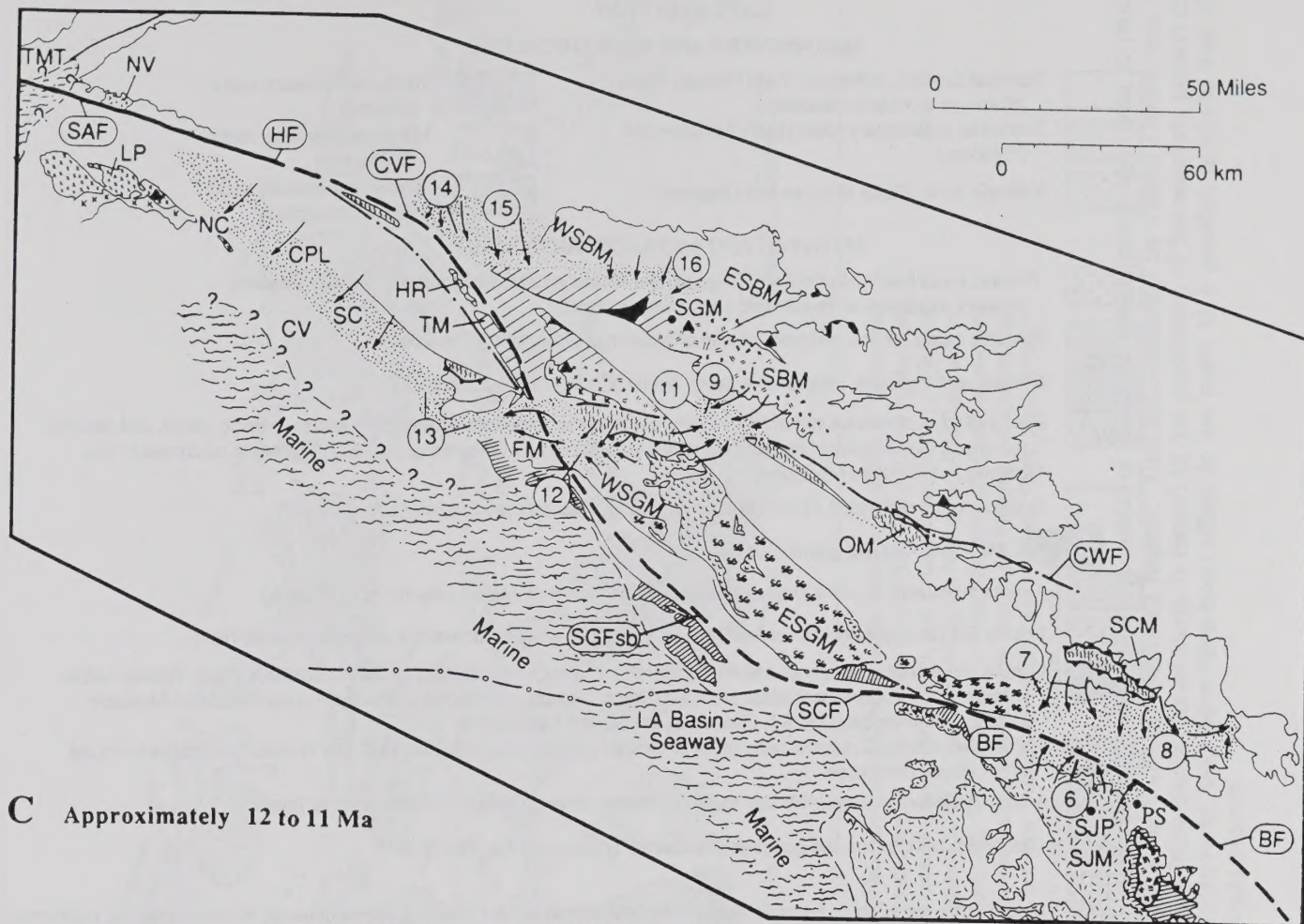
Palinspastic reconstruction at about 2.5 Ma. The Mission Creek strand of the San Andreas fault has generated about 50 of its 89-km displacement. Initial left-lateral displacements on the Pinto Mountain fault (PMF) are beginning to develop a bend in the Mission Creek strand. BCF = Blue Cut fault; CP = Cajon Pass region; CVS = Coachella Valley segment, San Andreas fault; ESBM = eastern San Bernardino Mountains; ESGM = eastern San Gabriel Mountains; FM = Frazier Mountain region; GF = Garlock fault; LSBM = Little San Bernardino Mountains; MCS = Mission Creek strand, San Andreas fault; MDS = Mojave Desert segment, San Andreas fault; NV = Neenach Volcanic field; OW = Old Woman Sandstone of Vaughan (1922) as used by May and Repenning (1982) and Sadler (1982a, b); PP = sediments of Phelan Peak deposits of Meisling and Weldon (1989); PS = Palm Springs; SAF = San Andreas fault; SGM = San Geronio Mountain; SJM = San Jacinto Mountains; SJP = San Jacinto Peak; SRM = Santa Rosa Mountains; TM = Table Mountain; WSBM = western San Bernardino Mountains; WSGM = western San Gabriel Mountains.

Figure 14a. Reconstruction of the southern California region showing the progressive offset on the San Andreas system, offset of the Peninsular Ranges and San Gabriel Mountains from their original positions, and sedimentation and marine seaways. City of Coachella shown as star. Reconstruction according to Matti and Morton (1993) for time of 2.5 million years ago, where the Imperial seaway connection to the Gulf of California is present. Coachella is shown as being opposite the northern Chocolate Mountains, about in the current position of Bombay Beach.



Palinspastic reconstruction at about 4.5 to 4.0 or 3.5 Ma. The Punchbowl–Wilson Creek strand of the San Andreas fault has been abandoned after generating about 40 km of right slip and the Mission Creek strand of the San Andreas has been initiated. BCF = Blue Cut fault; CF = Chiriaco fault; CP = Cajon Pass region; CVS = Coachella Valley segment, San Andreas fault; ESBM = eastern San Bernardino Mountains; ESGM = eastern San Gabriel Mountains; FM = Frazier Mountain region; GF = Garlock fault; HR = Holcomb Ridge; JH = sediment of the Juniper Hills Formation of Barrows (1987); LSBM = Little San Bernardino Mountains; MCS = Mission Creek strand, San Andreas fault; MDS = Mojave Desert segment, San Andreas fault; NV = Neenach Volcanic field; PS = Palm Springs; SAF = San Andreas fault; SGM = San Geronio Mountains; SJM = San Jacinto Mountains; SJP = San Jacinto Peak; SRM = Santa Rosa Mountains; TM = Table Mountain; WSBM = western San Bernardino Mountains; WSGM = western San Gabriel Mountains.

Figure 14b. Reconstruction of the southern California region showing the progressive offset on the San Andreas system, offset of the Peninsular Ranges and San Gabriel Mountains from their original positions, and sedimentation and marine seaways. Reconstruction and caption according to Matti and Morton (1993) for time of 4 million years ago. Imperial Seaway connection to the Gulf of California is shown interfingering with coarse clastic rocks of the Palm Springs, Canebrake, and Painted Hill Formations.



Palinspastic reconstruction at about 12 to 11 Ma after 115 ± 10 km of right slip has occurred on the Clemens Well-Fenner-San Francisquito-San Andreas fault; the Clemens Well-Fenner-San Francisquito segment of this fault has been abandoned. Left slip on the Malibu Coast-Banning fault system is completed. The right-lateral San Gabriel-Banning fault is about to be initiated. Deposition of the Mint Canyon Formation continues, but we infer that the unit now is accumulating only in the western part of its depocenter. BF = Banning fault; CP = Cajon Pass region; CPL = Carrizo Plain region; CV = Cuyama Valley region; CVF = Cajon Valley fault; CWF, Clemens Well fault; ESBM, eastern San Bernardino Mountains; ESGM = eastern San Gabriel Mountains; FM = Frazier Mountain region; HF = Hitchbrook segment of San Gabriel-Cajon Valley fault; HR = Holcomb Ridge; LP = La Panza Range; LSBM = Little San Bernardino Mountains; NC = northern Caliente Range; MCF = Malibu Coast fault zone; NV = Neenach Volcanic field; OM = Orocopia Mountains; PS = Palm Springs; SAF = San Andreas fault; SCF = Stoddard Canyon fault; SCM = southern Chocolate Mountains; SCR = southern Caliente Range; SGFsb = San Gabriel fault (south branch); SGM = San Geronio Mountain; SJP = San Jacinto Mountains; SJP = San Jacinto Peak; TM = Table Mountain; WSBM = western San Bernardino Mountains; WSGM = western San Gabriel Mountains.

Figure 14c. Reconstruction of the southern California region showing the progressive offset on the San Andreas system, offset of the Peninsular Ranges and San Gabriel Mountains from their original positions, and sedimentation and marine seaways. Reconstruction according to Matti an Morton (1993) for time of 11-12 million years ago, when major offset along San Andreas related fault features is thought to have largely started. Motion on the western Salton Trough detachment system was ending at this time and had produced the exposure of the Orocopia Schist present in the Chocolate and Orocopia Mountains and the well-developed fault features in the Santa Rosa Mountains south of Palm Springs (PS) and west of and beneath the Coachella General Plan Area.

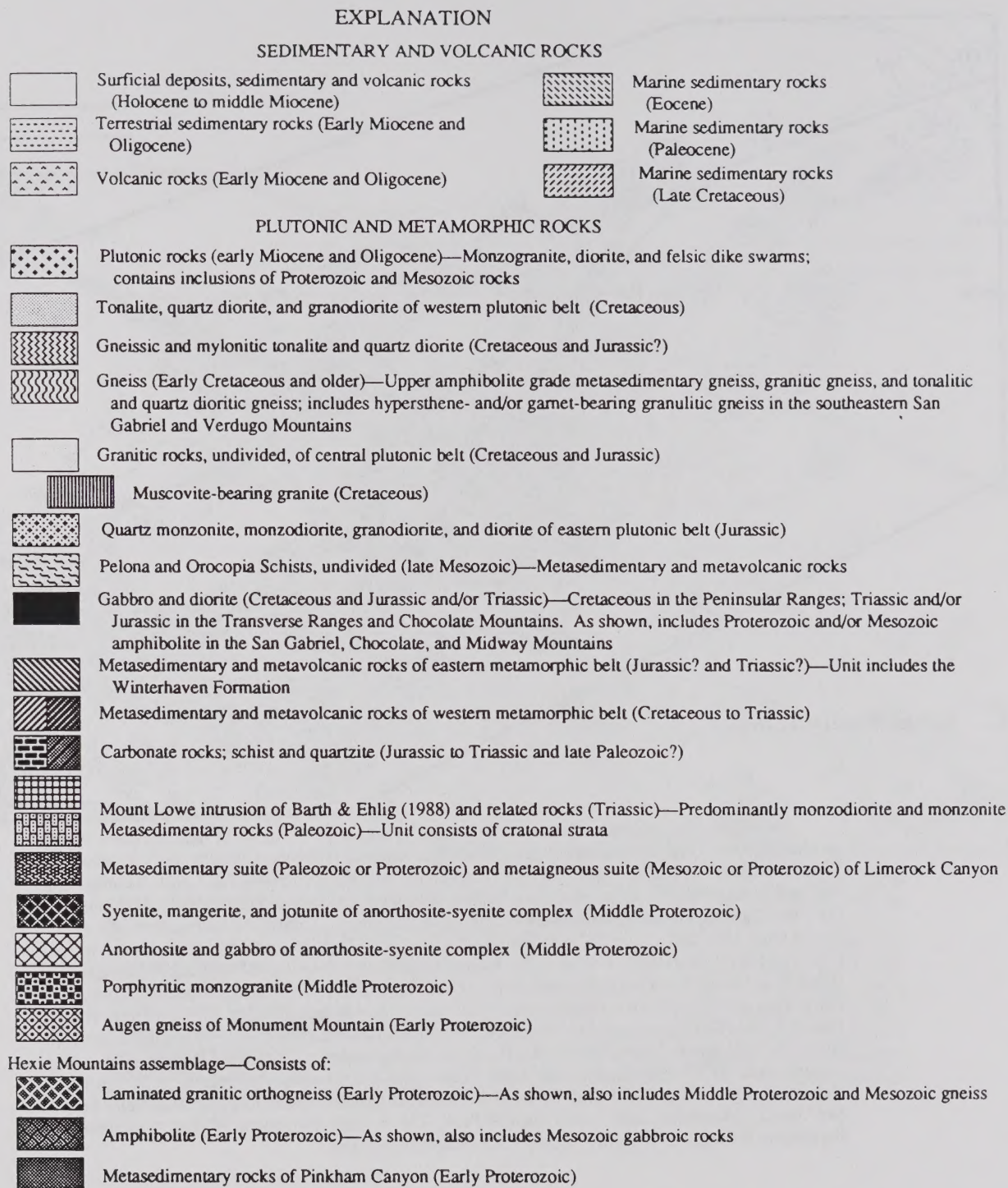
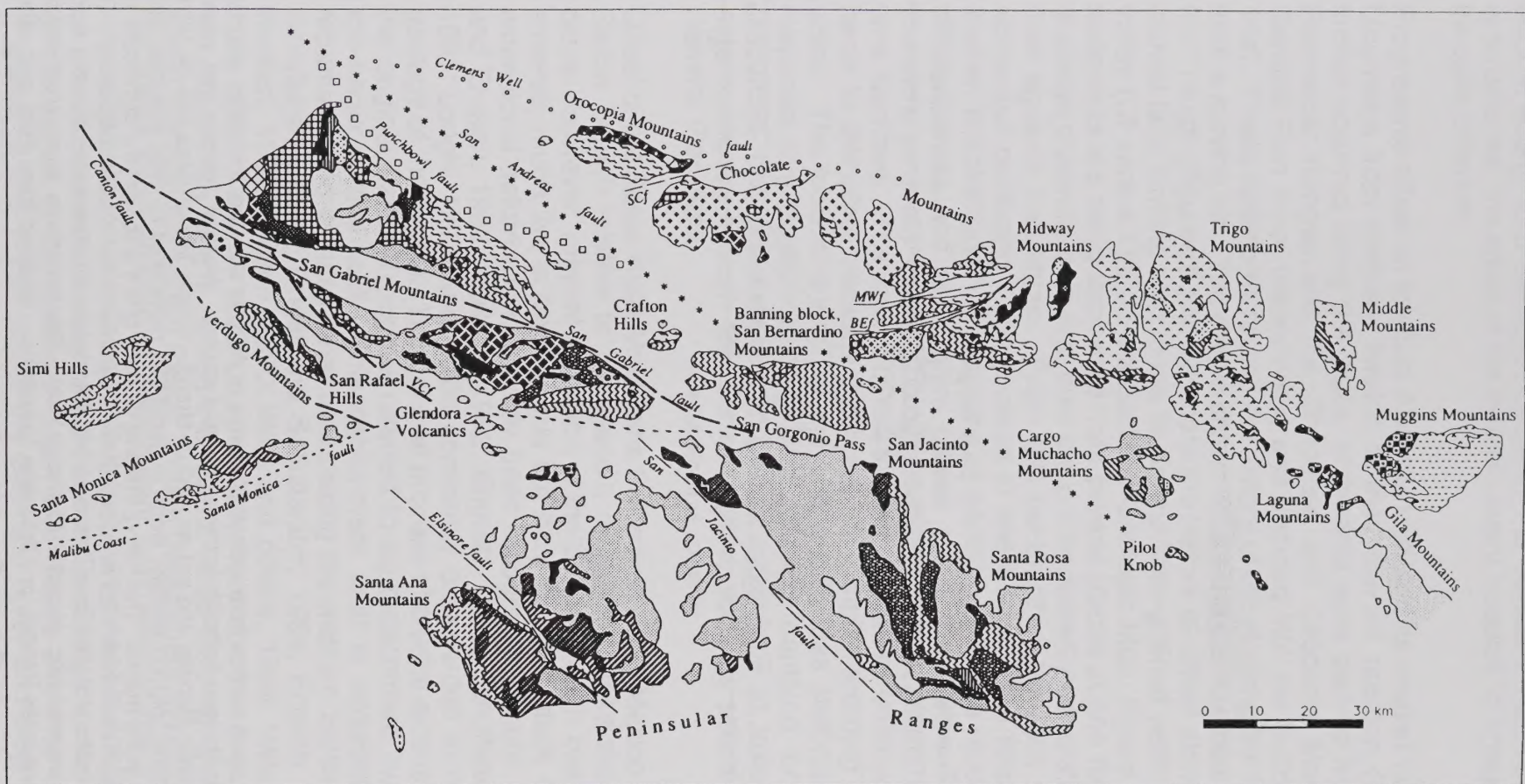


Figure 14d. Description of rock units for Figures 14a through 14c. Reconstruction of rock units to be in proximity to similar rock units is one of primary controls of these reconstructions. From: Matti and Morton (1993).



Paleogeologic map (ca. 20 Ma) showing reassembly of the southern boundary of Transverse Ranges province. Reconstruction constrained by cross-fault ties proposed by Ehlig (1966) for the San Gabriel fault, Dillon (1976) for the southern San Andreas fault, and Campbell and Yerkes (1976) for the Malibu Coast–Santa Monica–Raymond fault and by the distribution of the metasedimentary suite of the Limerock Canyon assemblage (see text). See explanation to Plate I for sources of geology shown. Blank areas are now covered by Quaternary surficial deposits, by Miocene or Pliocene sedimentary and volcanic rocks, or are minor gaps between reassembled blocks. BEf = Black Eagle fault; MWf = Mammoth Wash fault; SCf = Salton Creek fault; VCf = Vasquez Creek fault.

Figure 14e. Reconstruction of mountain ranges and major rock types for the time period of about 20 million years ago, prior to much of the faulting that gave rise to the current mountains and valleys of the southern California region. This reconstruction by Powell (1993) was done independently of that of Matti and Morton (1993), yet reaches fairly similar conclusions in regard to the placement of the westerly portion of the Coachella General Plan Area in northernmost Mexico. The Santa Rosa Mountains have been offset to the north to a position opposite that of the Orocopia Mountains along the multiple faults of the San Andreas system.

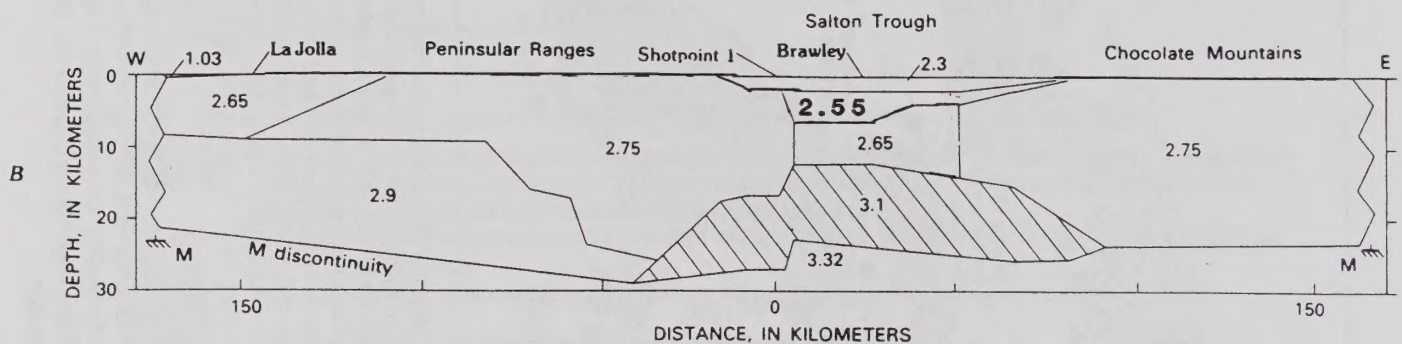


Figure 15. Diagrammatic cross section from coastal California to Arizona showing the major structural blocks on a crustal scale. Peninsular Ranges batholith is thick, cold and strong. Western Arizona and eastern California are thinner than the Peninsular Ranges and not as rigid or strong. Salton Trough area has by far the thinnest crust and is underlain by a “pillow” of high density, warm material that represents basaltic magmas added to the base of the crust from a source in the mantle. This heavy material (density of 3.1 g/cc) plays a significant role in pulling the crust down to make a basin into which thick accumulations of sediments have been deposited. This is much like filling a boat with heavy rocks along its base, the boat will sink deeper into the water (mantle) than it would have if it were filled with lighter material (e.g. density 2.75 g/cc or less). This material is young crust and it is much warmer than the adjacent Peninsular Ranges or Chocolate Mountains. Modified from Fuis and others (1982).

ence in energy to break a frozen candy bar versus a warm one. Because the force required is so different, the effect of the seismic event needed to break these different areas will likely be quite different.

Progressive offset on the San Andreas fault and its related faults has moved the Santa Rosa Mountains from northern Mexico to their current position (Figures 14a through 14e). As motion occurred along the faults, sediments were derived from both the high portions of the Peninsular Ranges and the Chocolate and Orocopia Mountains (west and east of the General Plan Area, respectively) and dumped into the Salton Trough (Figures 14b through 14e). These sediments record the history of offset along the faults, much like throwing debris from a moving car. The debris shows where the car has been. The alluvial rocks of the Salton Trough (Figures 6 and 8) record the history of offset along the faults, with coarse-grained alluvial fans forming next to the faults and finer-grained sediments forming in the center of the valley (Qf versus Qpl on Generalized Geologic Map, Figure 5, of the Plan Area). Because sediments are being deposited from several places at one time, as fans coming from several drainage channels or rivers, they are not necessarily correlative from one place to another in their ages or sequences. From this perspective, the rock units of the Salton Trough are somewhat confusing if one expects to see a layer-cake stratigraphy like the Grand Canyon. Rather, the stratigraphy or layering of geologic units is a record of processes that occurred at different times and at different places within the Salton Trough region. Names of units therefore generally record lithologic identities (like fanglomerate or lake deposits), rather than time identities. The apparent relationships between units are complex from one side of the basin to the other because the units are simply recording filling of the basin from several sides. The local character of the stratigraphy has important implications for both seismic response (liquefaction and ground shaking damping or amplification), potential water resources, and sub-surface transport of hazardous or toxic materials. This stratigraphy is heterogeneous enough that considerations such as seismic response will vary across the General Plan Area.

Offset of the Santa Rosa Mountains to the north from Mexico moved the western margin of the Salton Trough relative to the eastern margin by strike-slip faulting, like a sliding deck of cards. However, original formation of the Salton Trough basin occurred earlier by a different process, much like pulling the rug out from under a stack of books. This earlier history of extensional deformation has only been recognized (Figure 16) for about 15 years (Wallace and English, 1982; Wallace, 1982; English, 1985; Schultejahn, 1984; Stinson, 1990; Wise, 1991; Lough, 1993) and is still commonly disregarded in many regional summaries of the geology of the region. The general process of crustal extension that appears to have formed the original Salton Trough is referred to as detachment faulting, or formation of a regional low-angle normal fault. This detachment fault is exquisitely exposed in the Santa Rosa Mountains and in many other areas along the western Salton Trough region (Wallace, 1982; Schultejahn, 1984; Engel and Schultejahn, 1984; English, 1985; Beckett, 1991; Frost and Beckett, 1991; Stinson, 1990; Blom and others, 1988; Wise, 1991; Frost and others, 1993, 1993, 1996; Kenline, 1992; Lough, 1993; Robinson and Frost, 1996). Within the Santa Rosa Mountains, this fault is termed the "Santa Rosa Mountains detachment fault", which is a portion of the larger Western Salton Trough detachment system. Although surface exposures of the Santa Rosa Mountains detachment fault west of the Plan Area are evident, the actual trace of this fault at depth beneath the Planning Area is not known, and as such is not shown on the Generalized Geologic Map (Figure 5). Similar crustal extension occurred within much of the region of the southern Basin and Range Province and extended and tilted ranges (Figures 16 and 17) all across the Colorado River and Mojave Desert regions (Pridmore and Frost, 1992), and along the margins of the Gulf of California (Figure 18).

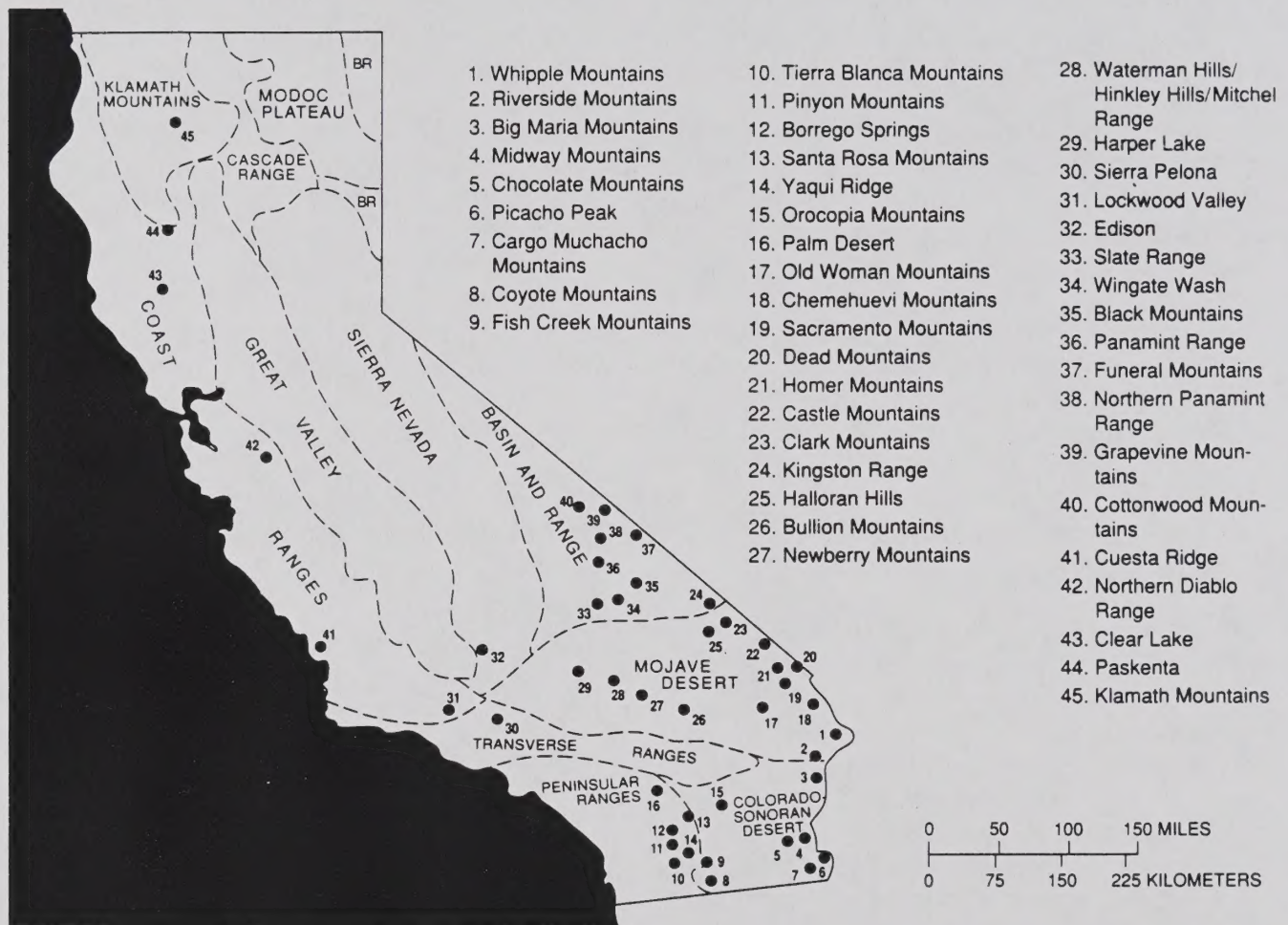


Figure 16. Regional diagram showing the known occurrence of mid-Tertiary detachment faulting in the California-Arizona region. This major crustal extension produced low-angle normal faults of regional extent. The Coachella General Plan Area is underlain by such a gentle fault of Miocene age. This fault is exceedingly well exposed along the western margin of the Santa Rosa Mountains and is inferred to be truncated by the San Andreas fault. Another fault of the same system of faults is exposed on the eastern margin of the Orocochia Mountains and dips toward the Colorado Plateau. This fault system is thought to be responsible for the original development of the Salton Trough. From: Pridmore and Frost (1992).

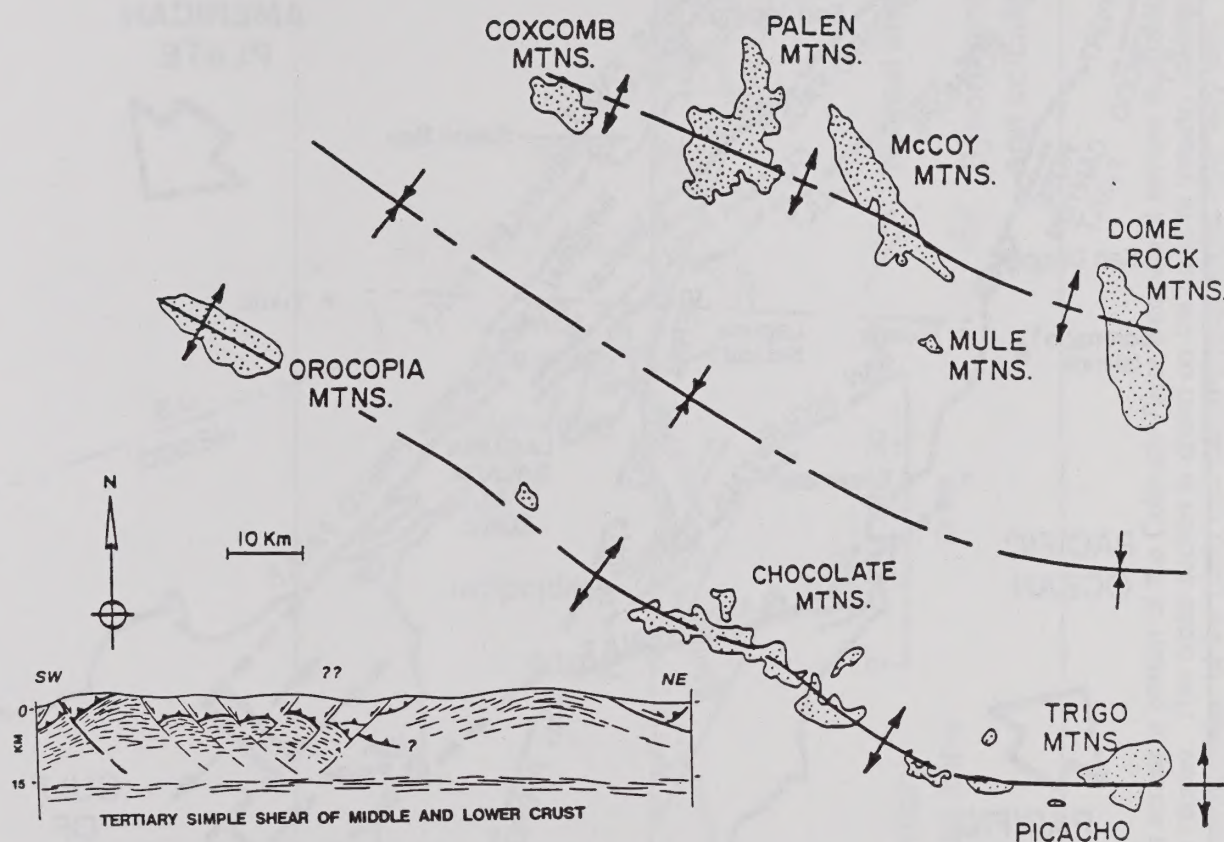


Figure 17. Diagrammatic map and cross section of some of the principal mountain ranges in southern California and western Arizona that contain thick sections of Mesozoic metasedimentary rocks that are thought to be correlative to the Orocochia Schist. These exposures of the Orocochia Schist in the Orocochia-Chocolate-Trigo Mountains and related rocks in the Coxcomb-Palen-McCoy-Dome Rock Mountains are like the tips of icebergs sticking above the desert alluvium. The units are thought to be continuous in the subsurface as shown in the cross section. They are offset along multiple normal faults, one of which is the Orocochia detachment fault that forms a prominent Miocene normal fault in the range east of the Coachella General Plan Area. The western Salton Trough detachment fault is part of the same extensional system that resulted from extending the crust across much of the southwestern United States. Because the Orocochia Schist and related units are relatively weak, earthquakes seem to occur mostly above this weak unit, which is more likely to deform by ductile motion than by brittle breaking by faulting. Much of the region west of the Plan Area is underlain by this unit and has predominantly shallow earthquakes, as opposed to deeper earthquakes in the region west of the General Plan Area within the Peninsular Ranges.

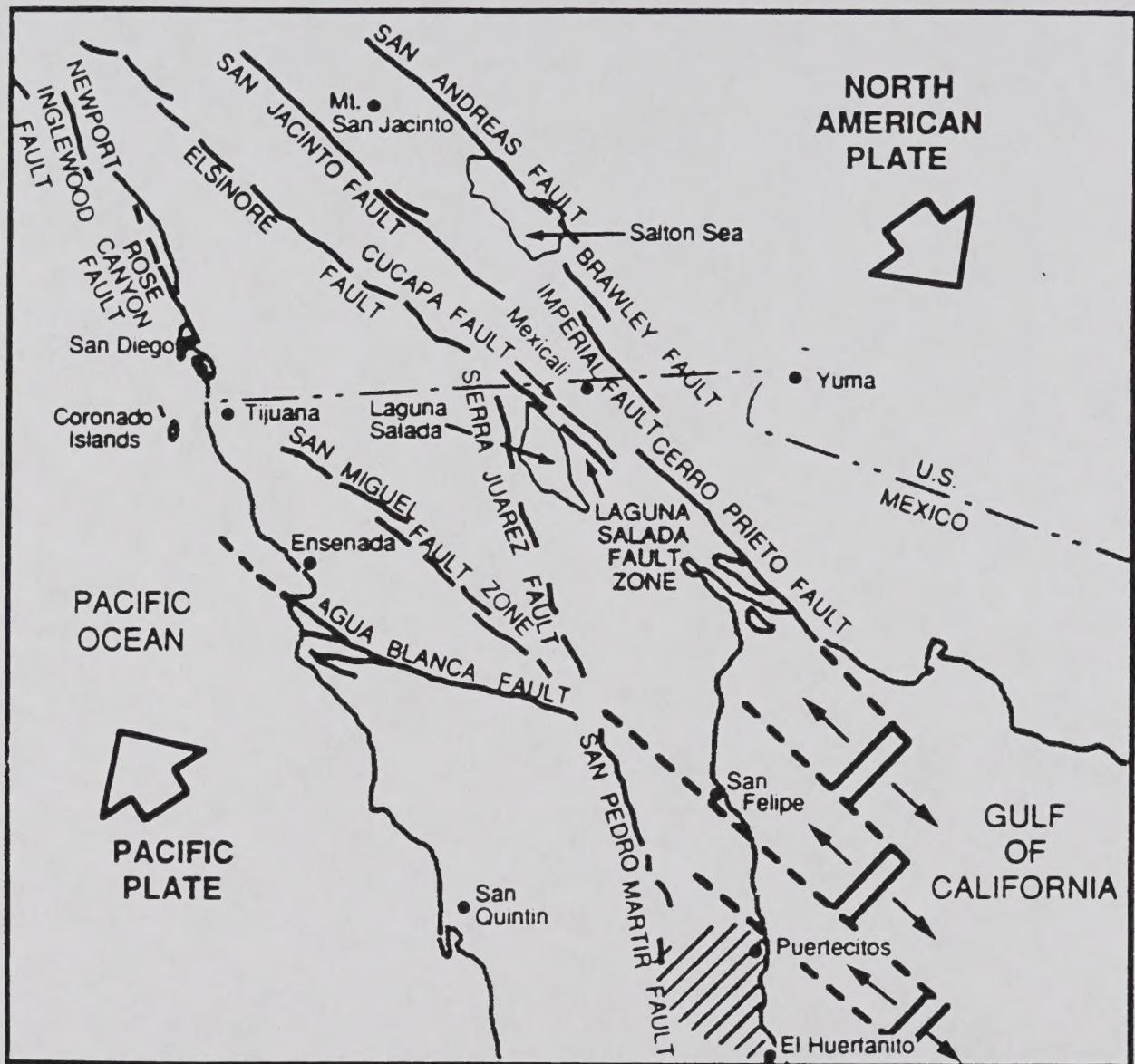


Figure 18. Gulf extensional province as defined by Stock and Hodges (1989). This region of extensional faulting separates Sonora, Mexico, from Baja California and continues to the north to the Palm Springs area. Evidence of Miocene crustal extension pervades this region with strike-slip faulting being the dominant mode of deformation, including the areas on all sides of the Coachella General Plan Area. The mode of modern-day deformation is dominantly strike-slip. Modified from Stock and Hodges (1989).

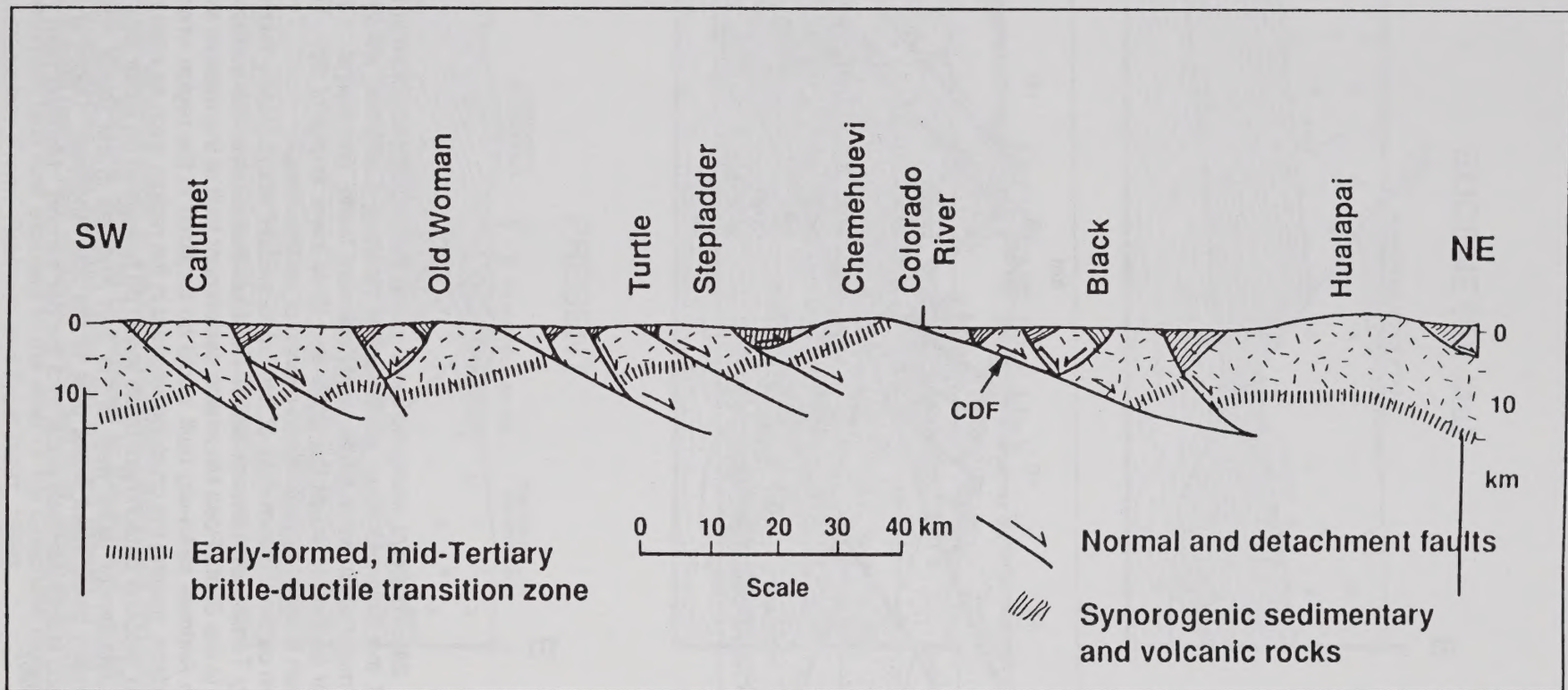


Figure 19. Regional cross section across a portion of the Colorado River extensional terrane illustrating the pattern of normal faulting and offset of ranges that has produced these ranges. This cross section is drawn on the basis of industry seismic lines shot across much of the region, many of which image the subsurface configuration of the faults and middle-crustal ductile layer very well. Both the Orocopia detachment fault and the western Salton Trough detachment fault would be continuations of this fault system. From: Frost and Heidrick (1996).

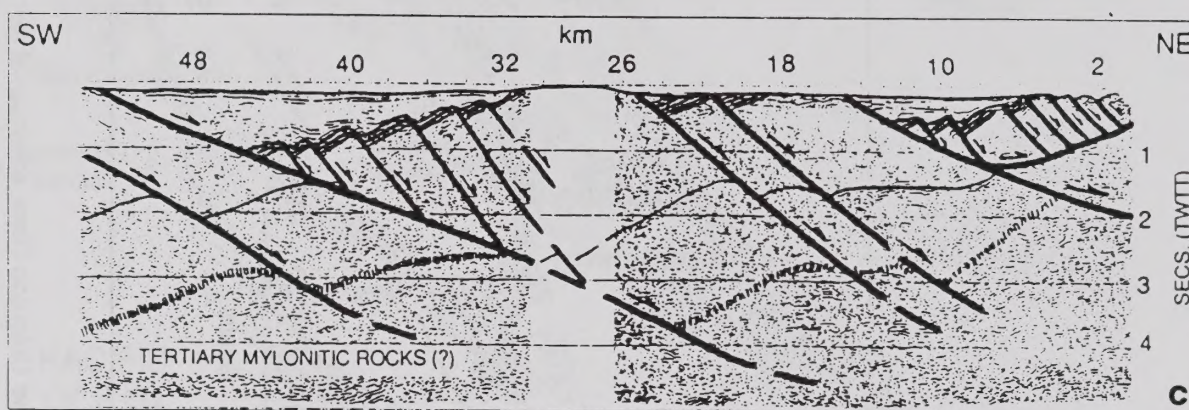


Figure 20. Portion of a seismic line showing the geologic structure of the upper 15 km of the crust in the area west of the Colorado River southwest of Needles, California, showing the tilt of the ranges and the development of major extensional faults, or detachment faults, and basins. Offset on the multiple faults allows ranges to tilt over on their sides as the faults also tilt to lower angles of dip. Tertiary mylonitic rocks are ductile middle crust, which is offset by rapid strain events, or earthquakes.

The basin on the western side of this cross section would closely mimic the original development of the Salton Trough by Tertiary detachment faults. The fault that reaches the surface at the western side of this basin would be similar to the Santa Rosa Mountains detachment fault at the western side of the Salton Trough.

The San Andreas strike-slip fault would be localized in the region where Miocene ductile crust reached closest to the surface, making the crust the weakest in the region, such as west of the blank area (no data) on the seismic line. The Miocene detachment faults would be preserved on either side of this middle-crustal weak zone, as seen in the detachment faults west of the San Andreas in the Santa Rosa Mountains and the Orocopia-Chocolate Mountains detachment faults east of the San Andreas. Depth is shown in two-way travel time for seismic waves, and is approximately equal to 3 km per second. Modified from Frost and Okaya (1987) and Frost and Heidrick (1996).

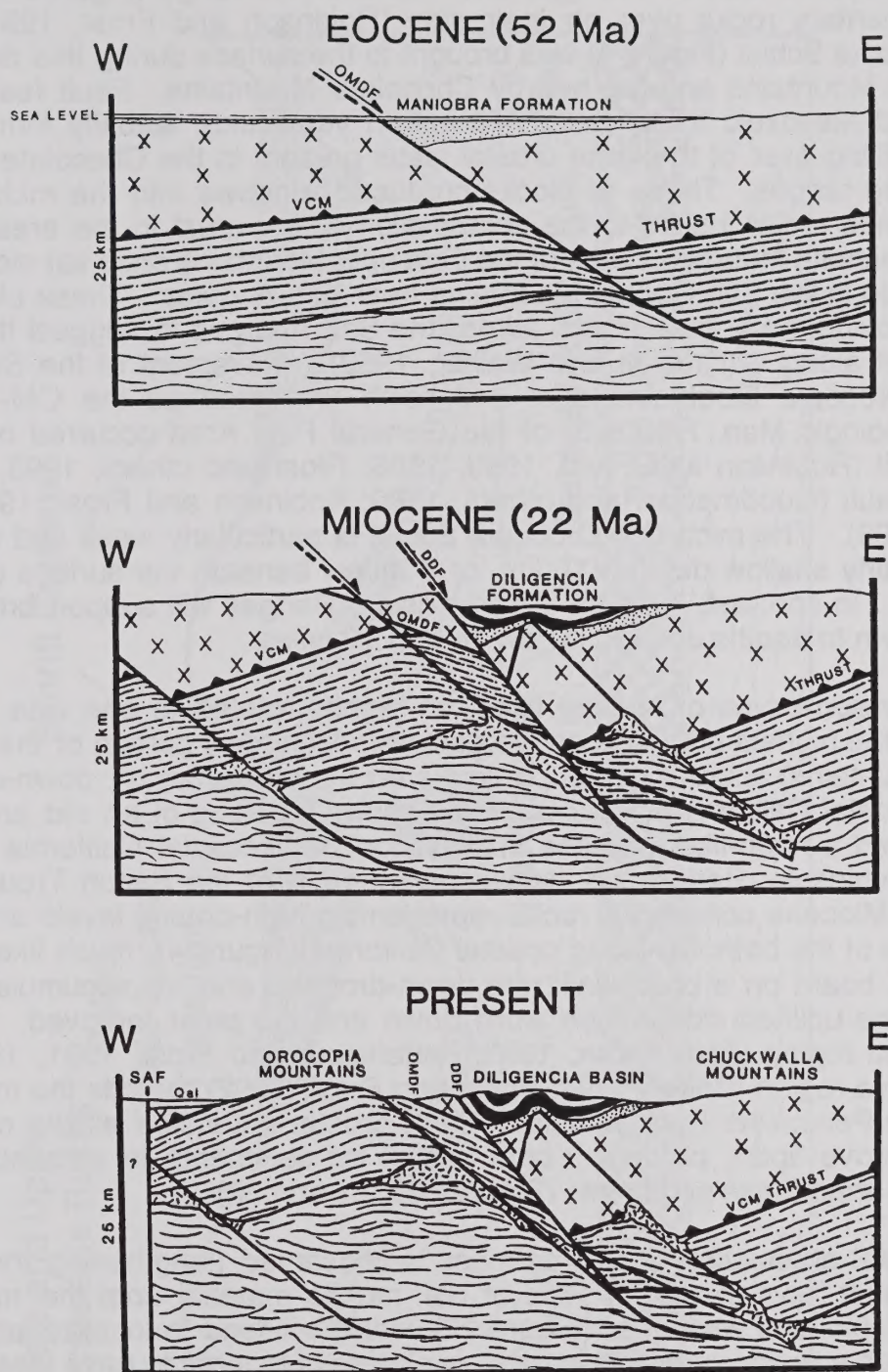


Figure 21. Model of the tilt-block origin of the Orocochia detachment fault and adjacent normal faults. Tilting over of this range allowed the Orocochia Schist to be exposed to the surface. Crustal thinning probably localized the placement of the modern-day San Andreas along the western margin of the Orocochia-Chocolate Mountains. This was probably because major offset occurred along this fault, which is probably the equivalent of the western Salton Trough detachment fault now exposed to the west of the Coachella General Plan Area along the margins of the Santa Rosa Mountains. From: Robinson and Frost (1991, 1996).

The blocks, or mountain ranges, tilt over on faults much like a set of books tilting over on a bookshelf (Figures 19 and 20). The nearby Orocopia Mountains have an extremely well developed detachment fault of this type and tilts both the range (Figures 17 and 21) and overlying sedimentary rocks over on their side (Robinson and Frost, 1991, 1996). The distinctive Orocopia Schist (Figure 4) was brought to the surface during this deformation both in the Orocopia Mountains and the nearby Chocolate Mountains. Fault features that were once considered Mesozoic thrust faults (72 million years old), actually formed by regional extension and tilting over of the large crustal slabs present in the Chocolate Mountains and most neighboring ranges. These tilt blocks produced windows into the middle crust of the region and provide major insight to the composition of the crust in the area. Precambrian rocks of the Coachella Mountains east of the Orocopia Mountains once sat atop the Orocopia Schist and still do in the San Gabriel Mountains near Los Angeles. These old, very unusual rocks helped provide the original match across the San Andreas to suggest that it had about 300 km of offset along it (Crowell and Walker, 1962). Movement of the San Gabriel type rocks off the Orocopia Mountains east and north (indicated as the OM-UPXLN unit of Generalized Geologic Map, Figure 5) of the General Plan Area occurred on the Orocopia detachment fault (Robinson and Frost, 1989, 1996; Frost and others, 1993, 1996) and the Clemens Well fault (Goodmacher and others, 1989; Robinson and Frost, 1989, 1996; Matti and Morton, 1993). The mica-rich Orocopia Schist is particularly weak and fails both brittly and ductily at fairly shallow depths (10 km, or 6 miles) beneath the surface (Magistrale and Sanders, 1994). In contrast, rocks of the Peninsular Ranges will support brittle breaking by earthquakes down to depths of 15 to 20 km, or 9 to 12 miles.

This same extensional type of faulting tilted, or slightly rotated to one side, the Peninsular Ranges so that the highest portion is on the easternmost, tipped portion of the block (such as Santa Rosa Mountains) and the lowest portion is on the westernmost, down-dropped portion of the block (coastal California). This is clearly shown by tilting of an old erosional surface that has produced a ramp-like increase in elevation from coastal California up to the high portion of the Peninsular Ranges on the western margin of the Salton Trough (Figure 22). Paleocene and Miocene continental rocks representing high-crustal levels are preserved on the western side of the batholith along coastal California (Figure 4), much like preserving the paint on a tilted board on a boardwalk; the down-dropped end will accumulate dirt over the paint whereas the uplifted side will be worn down and the paint removed. Faulting in the coastal California region (Fattahipour, 1993; Fattahipour and Frost, 1991, 1992, 1996) and offshore California region (Baker, 1994; Baker and Frost, 1992) records the movement of the west side of the Peninsular Ranges block. Such crustal extension allows mountain-range-size blocks to move apart, producing both basins for sediments to accumulate and topographic highs to shed these sediments (Figures 20, 21 and 22).

In addition, crustal attenuation occurs as mass is conserved (lengthening the cross section means that it must have thinned). Rise of hot, mobile material from the middle crust will produce broad regions of weakness (Figure 22), which will tend to localize later deformation. Formation of such a region of middle-crustal weakness is thought to have localized the actual course of the San Andreas, so that the major, regional detachment fault occurs west of the San Andreas in a fault system with east-dipping detachment structures. This is what is observed as the Santa Rosa Mountains detachment fault dips toward the San Andreas and tilts gently beneath the Salton Trough (Figures 23a and 23b) and General Plan Area. This fault is interpreted to extend to the nearly vertical San Andreas fault, where it would be truncated. The three-dimensional form of this earlier extensional fault may provide powerful keys (piercing points) for exactly matching from one side of the original San Andreas to the other, thus providing tighter constraints on the movement history of the San Andreas fault system.

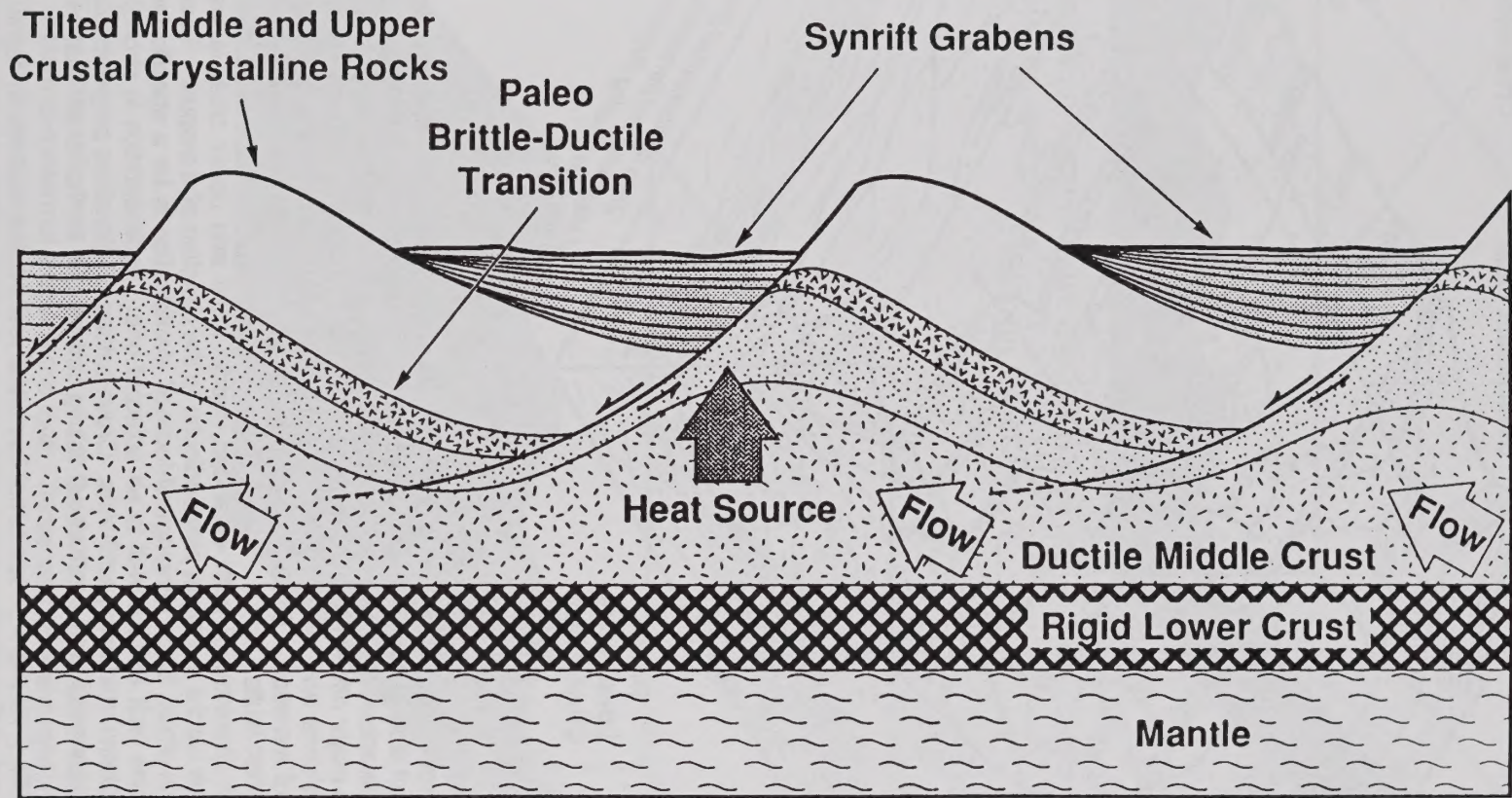


Figure 22. Schematic diagram showing tilting of mountain ranges by brittle faults above a ductile middle crust and development of sedimentary sections (synrift grabens) between the fault blocks. The lower crust is composed of quartz-poor, more rigid rocks that do not deform as the ductile middle crust or brittle fractured and rotated upper crust. This model is thought to be similar to that of the development of the original Salton Trough. Flow of the ductile middle crust occurs to fill the spaces beneath the tilting mountain ranges. Where the largest bodies of ductile middle crust are exhumed (uncovered or elevated), and where heat flow is greatest, is also thought to be the areas where later strike-slip faults, such as the San Andreas will be localized. Openings along releasing bends within the strike-slip system allow heat (geothermal) energy to rise to the surface. Modified from: Frost and Heidrick (1996), Heizer and Frost, unpub. work.

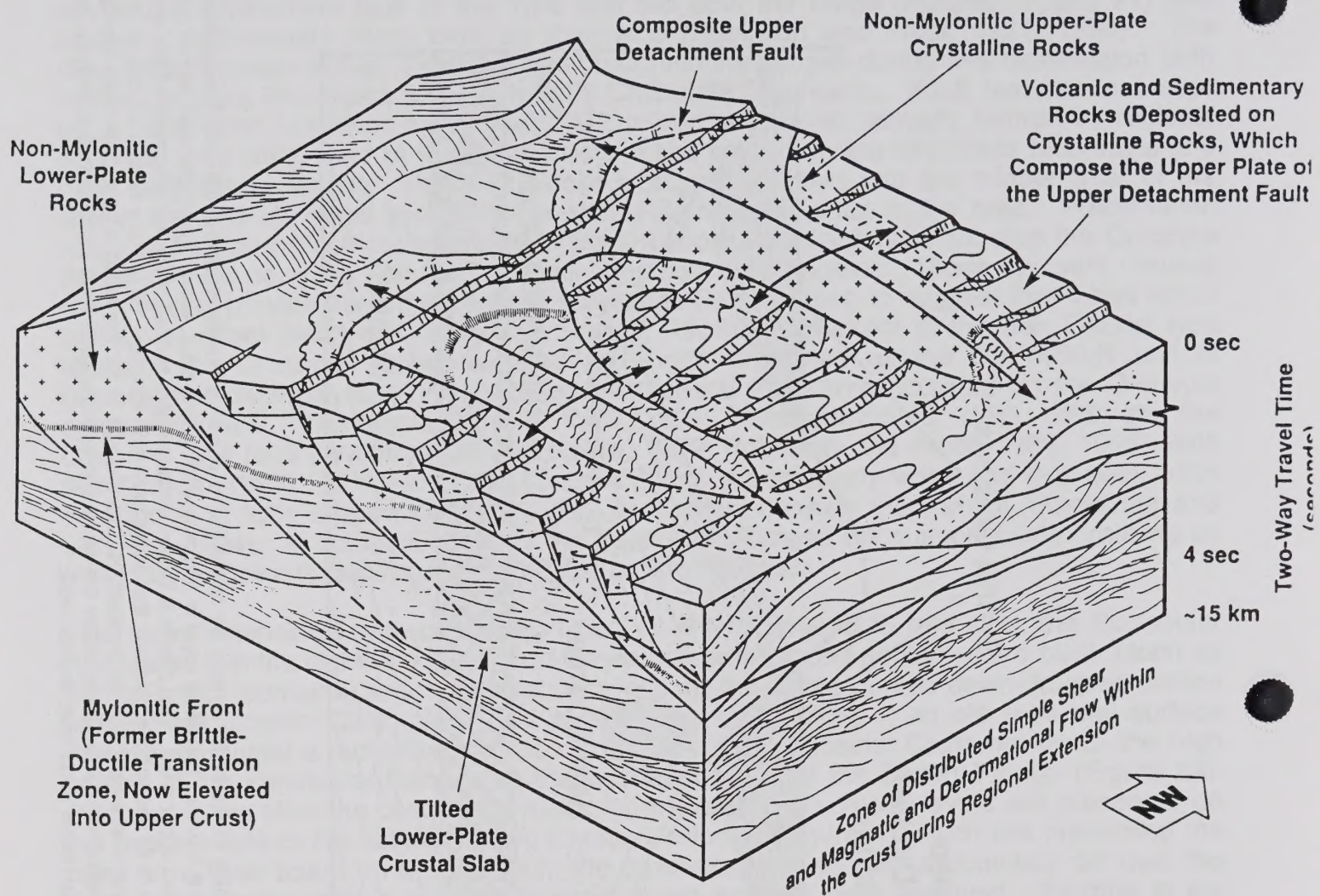
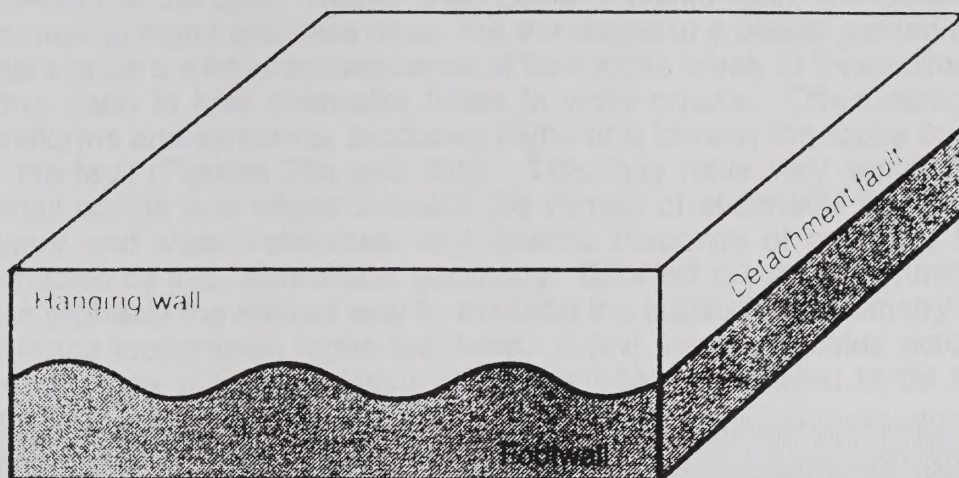


Figure 23a. Three-dimensional model of idealized detachment system showing wave-like character of faults. Major fault on the left side of drawing has moderate dip and extends into the middle crust, very similar to the western Salton Trough detachment system. Antiform-synform shape of this fault is very typical of most detachment faults. Where major offset and especially offset involving two or three generations of faults (model of Proffett, 1977), these antiforms and synforms lay over on their sides, developing antiformal-synformal ranges elongate in the direction of transport. Offset of early-formed faults by later faults of listric character produces hangingwall rollover of the first faults.

Three-dimensional character of both extended middle crust and upper crust is well displayed in this diagram. Upper-crustal fault blocks are offset perpendicular to the direction of transport. Lower-plate fault blocks are similarly offset from each other. Each hangingwall-footwall identification is for a specific fault only, since many areas are hangingwall to one fault and footwall to an adjacent one. Sedimentation is strongly controlled by the shape of the faults, half grabens, and rising antiforms. Cross-cutting relationships perpendicular to the direction of tectonic transport are pronounced and produce a strong anisotropy in the crust that is visible by several geophysical techniques.

Major tilting of middle crust exposes once middle-crustal rocks to the surface in highly extended terranes. Such offset moves rocks out of the ductile regime into a higher-crustal, brittle regime. Orocopia and Chocolate Mountains are excellent examples of this ductile to brittle transition within a single deformational phase lasting for several millions of years. From: Frost and Heidrick (1996).



Large corrugations are mountain-size troughs and crests.

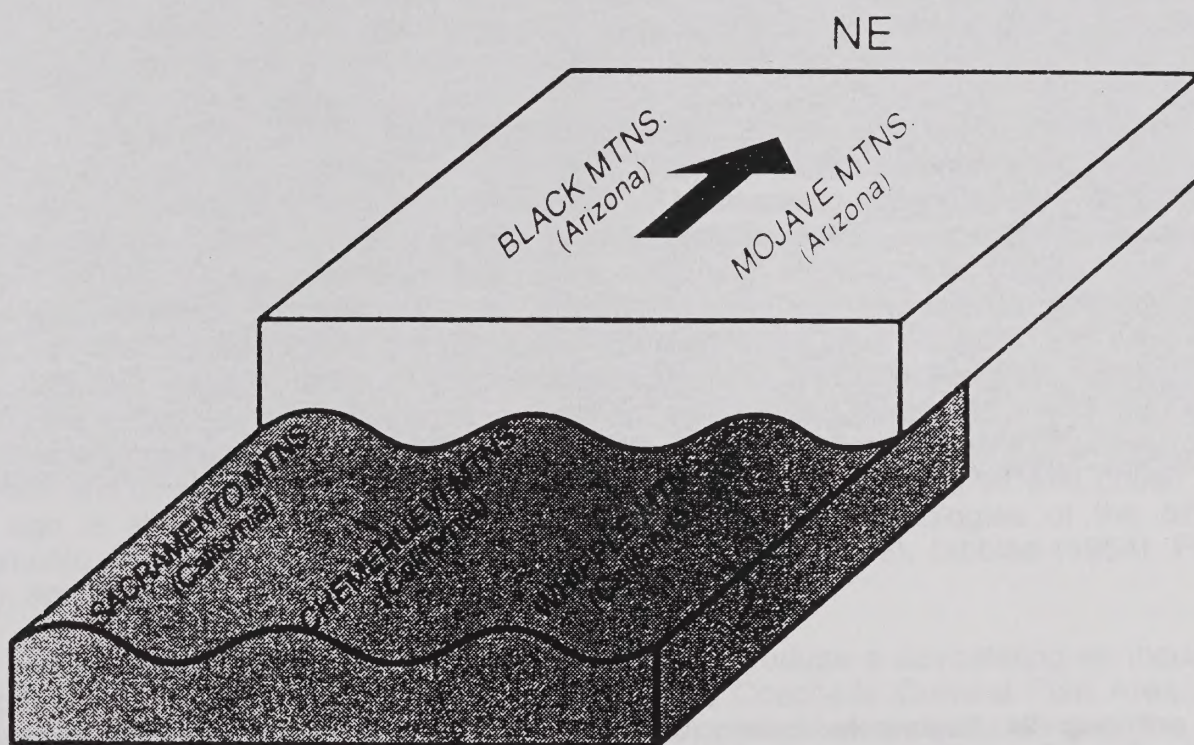


Figure 23b. Schematic map of a portion of the Santa Rosa Mountains detachment fault showing the development of the antiformal-synformal shape of the fault. These antiforms and synforms are very pronounced in the range and are thought to develop sub-basins in the subsurface of the northern portion of the Salton Trough in the vicinity of La Quinta and Coachella. Detachment fault is well exposed on Seven Levels hills south of Palm Desert and in hills just west of La Quinta. Much of the eastern slope of the Santa Rosa Mountains is the exhumed fault ramp of the Miocene detachment fault. From: Wise (1991).

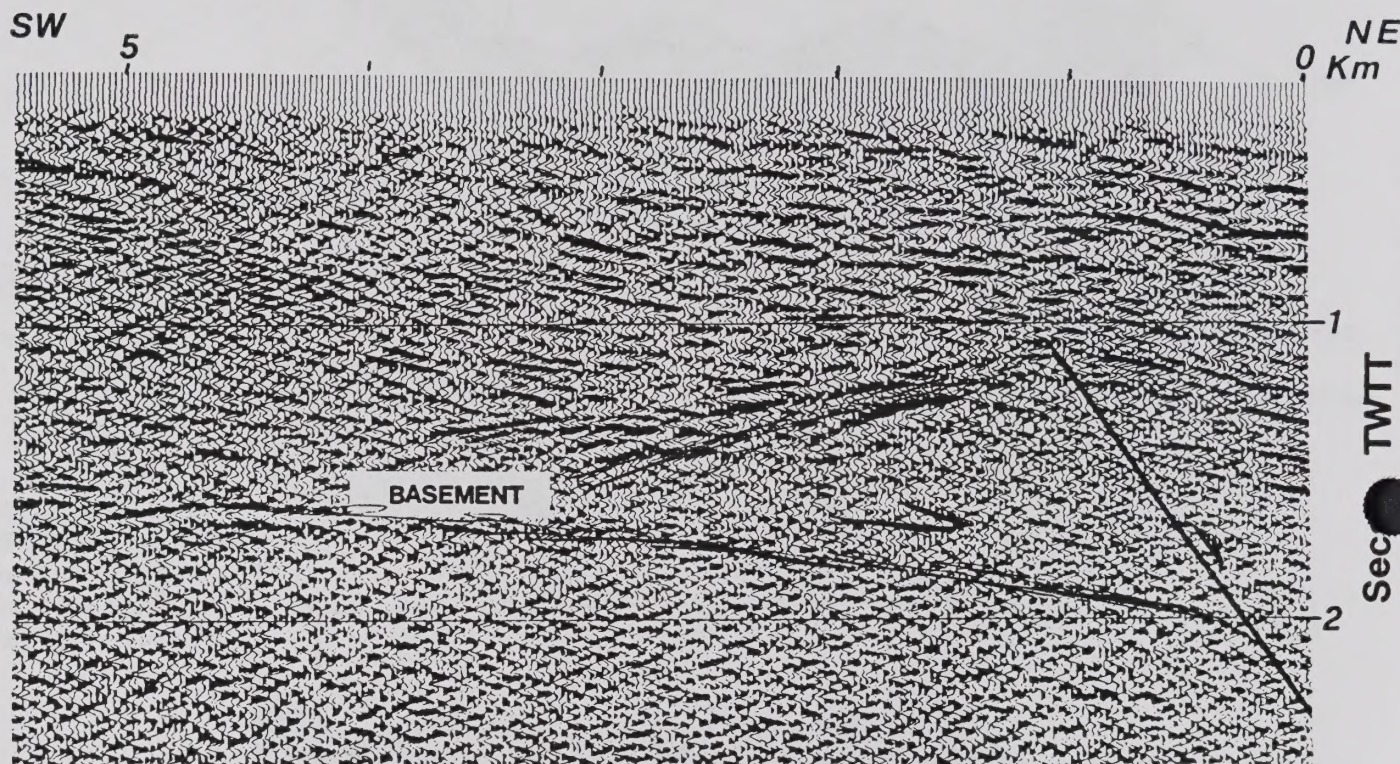


Figure 24. Reprocessed industry (Chevron) seismic line south of the Santa Rosa Mountains in the western Salton Trough showing prominent reflection interpreted as western Salton Trough detachment fault. Abundant reflections in the upper portion of the section are interpreted as basin filling sediments of post detachment age, most of which were derived from the adjacent mountain ranges to the west (left) and north. Reflection tilted to the west is typical of basement-sediment contact, as well. This very prominent reflection appears to be truncated by gently inclined reflection tilted to east (right). Where upper-plate crystalline rocks overlie lower-plate crystalline rocks, detachment fault does not image well because velocity of sound through both rocks is about the same, producing only faint reflection between rock bodies. Reflections are best viewed with head looking sideways at paper, so that reflections line up---much like band members in a marching band "line up" in diagonal rows when viewed in a parade. Eastern side is interpreted to be cut off by younger fault than detachment fault, which is also covered with younger sediments. This area was drilled, but no oil was found. Modified from Severson (1987) and Frost and others (1987).

One aspect of the geometry of the mid-Tertiary detachment fault that is particularly important is the wave-form of the fault. Rather than being a planar fault, the detachment fault has a wave form making highs and lows much like the shape of a plastic garden roof. Such a wave form appears to be a simple consequence of how rocks break in three-dimensional strain, as is commonly seen in how sidewalks break in wavy cracks. Offset along these highs and lows, or antiforms and synforms, produces highs and lows in the rocks overlying the fault as well as in the fault (Figures 23a and 23b). This may have very significant implications for forming small basins and ridges beneath the veneer of sediments filling the Salton Trough. Flow of water and water resources, and seismic response of overlying sediments may be distinctly affected by this subsurface geometry. Detailed gravity measurements and seismic surveys are probably the easiest way to evaluate the subsurface geometry of the detachment fault subsurface topographic highs and lows. A few seismic profiles across portions of the Salton Trough show major reflections that have been interpreted to be this gently inclined detachment fault (Figure 24).

Another use of the term "detachment fault" in the Salton Trough is that of Gerard Bond and Kenneth Hudnut (e.g., Hudnut and others, 1988). In their usage of the term, the middle crust is detached or decoupled from the upper crust, thus allowing upper-crustal motion to occur within blocks within the brittle regime (Figures 25 and 26). Whether these modern-day zones of crustal movement are equivalent or genetically related to the Salton Trough and Coachella General Plan Area is not well understood. Similar relationships between strike-slip faulting and detachment faulting are present in many other areas of the world (Corona, 1993).

2.1.2.2 Indio-Mecca Hills, San Andreas Fault. Prominent hills in the northern and eastern portion of the Coachella General Plan Area are composed of interbedded sandstones and shales of Miocene to Quaternary age. These young sediments (Qf, Qt, Qlso, Qo, Qpu, QTpa, QTps, TQb, and TQm) overlie Precambrian crystalline rocks (OM-UPXLN) in the core of the Mecca Hills and Orocopia Schist east and south of the Mecca Hills. This sedimentary veneer is strongly deformed in both the Indio and Mecca Hills and provides a window into the composition of the rocks at depth below the lake deposits and wind-blown sands, silts and clays of much of the Coachella Valley. The sediments of the Indio and Mecca Hills record a long history of deposition and faulting associated with the Salton Trough tectonic margin. The thickness of the sediments in the center of the Coachella Valley (Sylvester and Crowell, 1989) as calculated from gravity surveys and an oil well drilled many years ago is about 3200 meters (more than 10,000 feet). Lithologies of the different stratigraphic units are well described by Sylvester and Smith (1976), Dibblee (1954), Proctor (1968), and Sylvester and Crowell (1989.)

Offset along the main strand of the San Andreas fault to produce a devastating earthquake is the most commonly perceived geologic hazard to the Coachella General Plan Area. This perception is actually difficult to quantify because of our lack of understanding of the many segments of the San Andreas and their three-dimensional natures and interrelationships during seismic events. "San Andreas" is the name that has been given to a broad, mostly linear, collection of fault breaks that are seen on land in the San Andreas valley north of San Francisco and that traverse down the length of California. The name "San Andreas" is applied to one continuous zone of faulting from the San Francisco area to the Salton Sea. As discussed previously, this fault is generally described as the boundary between the Pacific plate and the North American plate (Figures 2,3,4,5 and 26). It is widely recognized that the actual motion is distributed on a complex system of interrelated faults, rather than on one discrete fault surface. Each segment, or strand, of the San Andreas system carries a

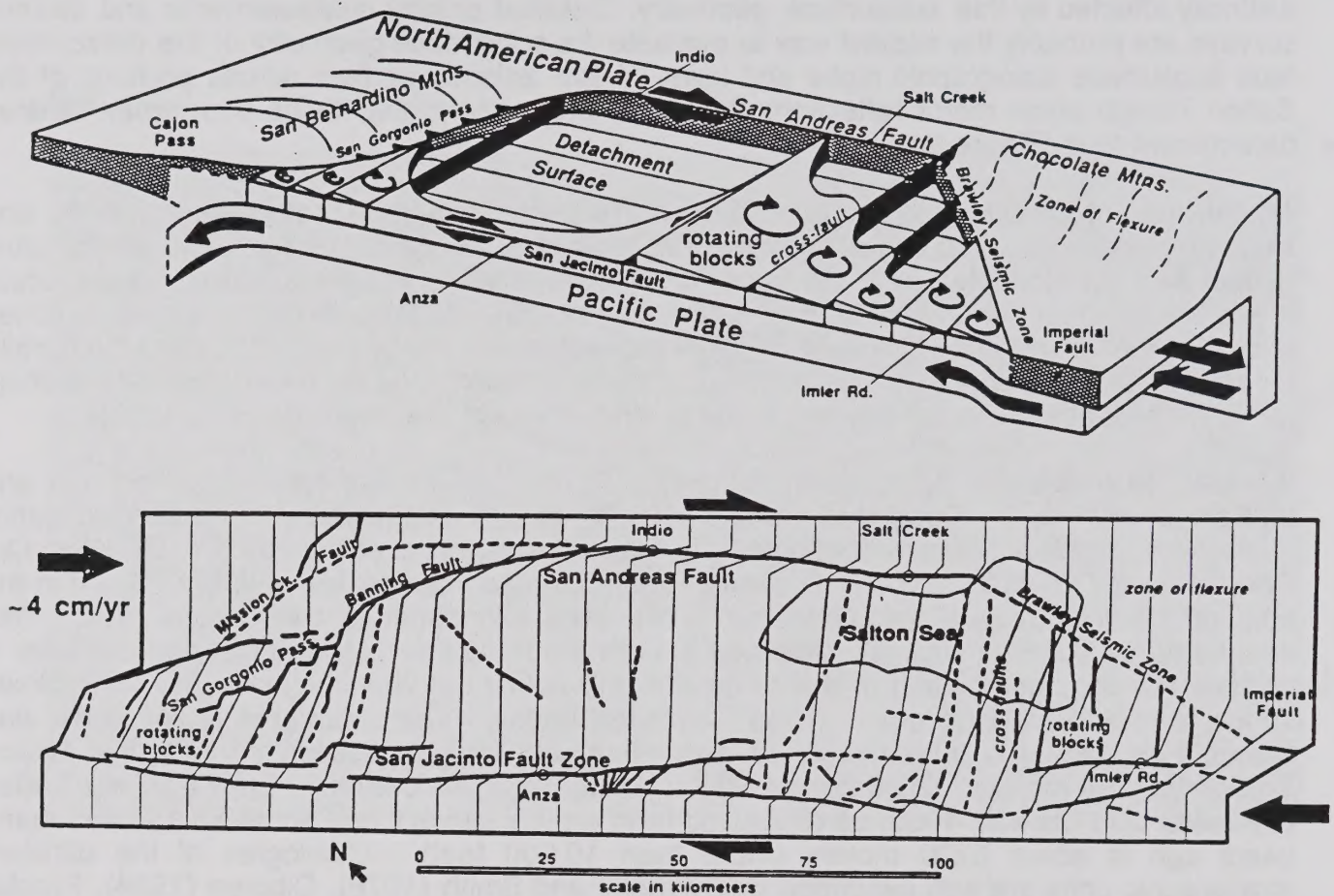


Figure 25. Block diagram showing modern-day detachment surface beneath the Salton Trough region in a model envisaged by Bond and Hudnut et. al. (1988). According to this model, a detachment fault existed during the development of the San Andreas and allowed upper-crustal blocks to rotate in a clockwise fashion above this fault. Rocks below the fault would be part of the Pacific plate in the Salton Trough area. Map view shows how San Jacinto fault straightens out the curved shape of the San Andreas. This inferred continuation of the Miocene detachment fault may have facilitated the rotation of blocks in the Salton Trough along both the northwest-striking and northeast-striking faults that are present there. Motion of multiple portions of these linked faults, as well as the underlying detachment fault, would occur during a major earthquake according to this model.

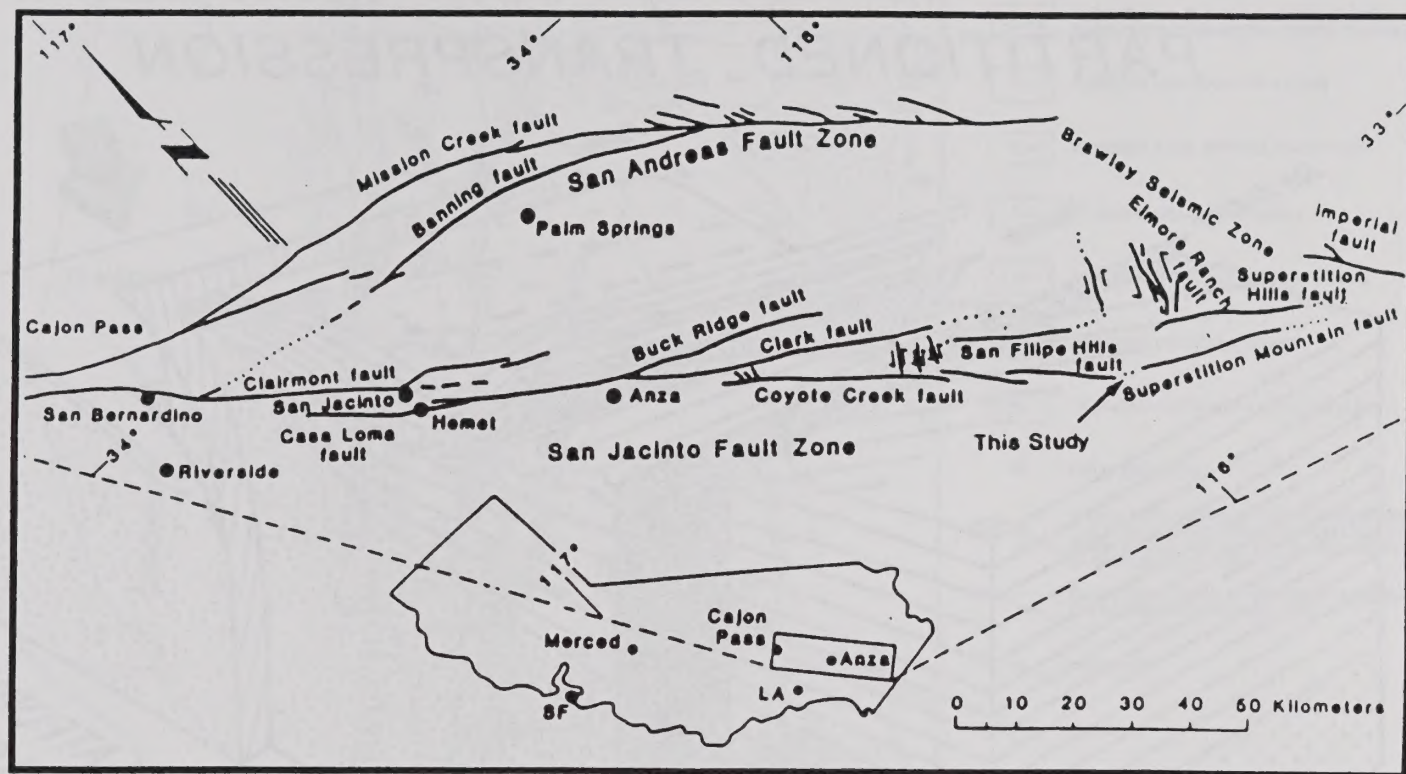


Figure 26. Map showing the principal strands of the San Andreas fault system and one of its primary sub-systems, the San Jacinto fault zone. San Jacinto fault zone is a complex array of related faults that are exposed at the Earth's surface. Although not directly connected to each other, these faults transfer motion from one fault to another during seismic motion. At depth, these faults are connected in the ductile middle crust, but also transfer their motion through a multitude of small faults and distributed deformation through the brittle upper crust.

Motion from the Imperial fault is transferred (steps to the right) to the San Andreas fault, whose southernmost extent is at the south end of the Salton Sea (Bombay Beach). Near San Bernardino, motion from the San Andreas and related faults (Banning, Mission Creek) is completely transferred to offset along poorly exposed faults within the San Bernardino Mountains to the north and to the seismically active San Jacinto fault to the southwest. This transfer of motion from one fault segment to another makes evaluation of the seismic risk for different sections of the different faults both difficult but completely interrelated.

Furthermore, this transfer of motion from one segment of the fault to another surrounds the Coachella General Plan Area on a large scale. The Coachella Valley sits in a zone of little seismicity between the San Andreas and San Jacinto faults, somewhat as if it was in the interior of the block. Slip rates of these faults vary along their strike, going from zero at the fault tips (beginnings and ends of the faults) to a maximum at some point along the fault. Maximum slip is not necessarily at the middle of the fault, because motion is continually transferred into and out of the fault to adjacent faults. Determining the slip along any segment of the fault thus requires determining the percentage of total motion within the San Andreas system that is occurring along that specific fault segment. Modified from: Gurrola (1994).

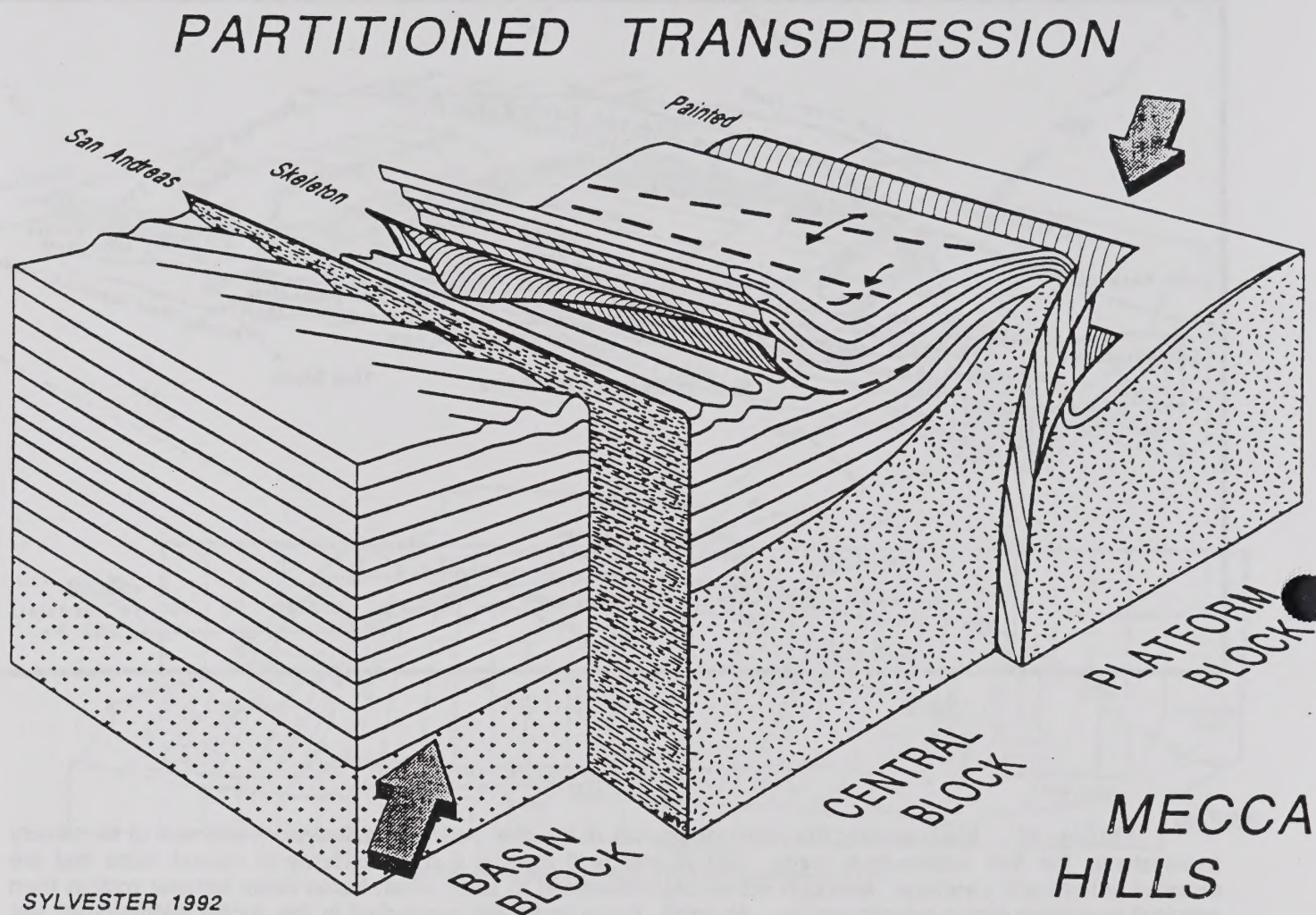


Figure 27. Diagrammatic block diagram of the Mecca Hills area according to Sylvester (1992). Deep basin to west (foreground) is deformed in complex structures along different strands of the San Andreas fault, producing fault patterns that have been called "flower structures" or "palm structures." Alternative interpretations of this deformation have also been made as fault-bend folds produced by compression across the fault. However these faults were developed, folding and faulting in the Mecca Hills area have produced some of the most spectacular geology in all California. The deformation along the San Andreas in this area attracts visitors from throughout the world; the geologic studies done on this area are world famous (e.g., Sylvester and Crowell, 1989).

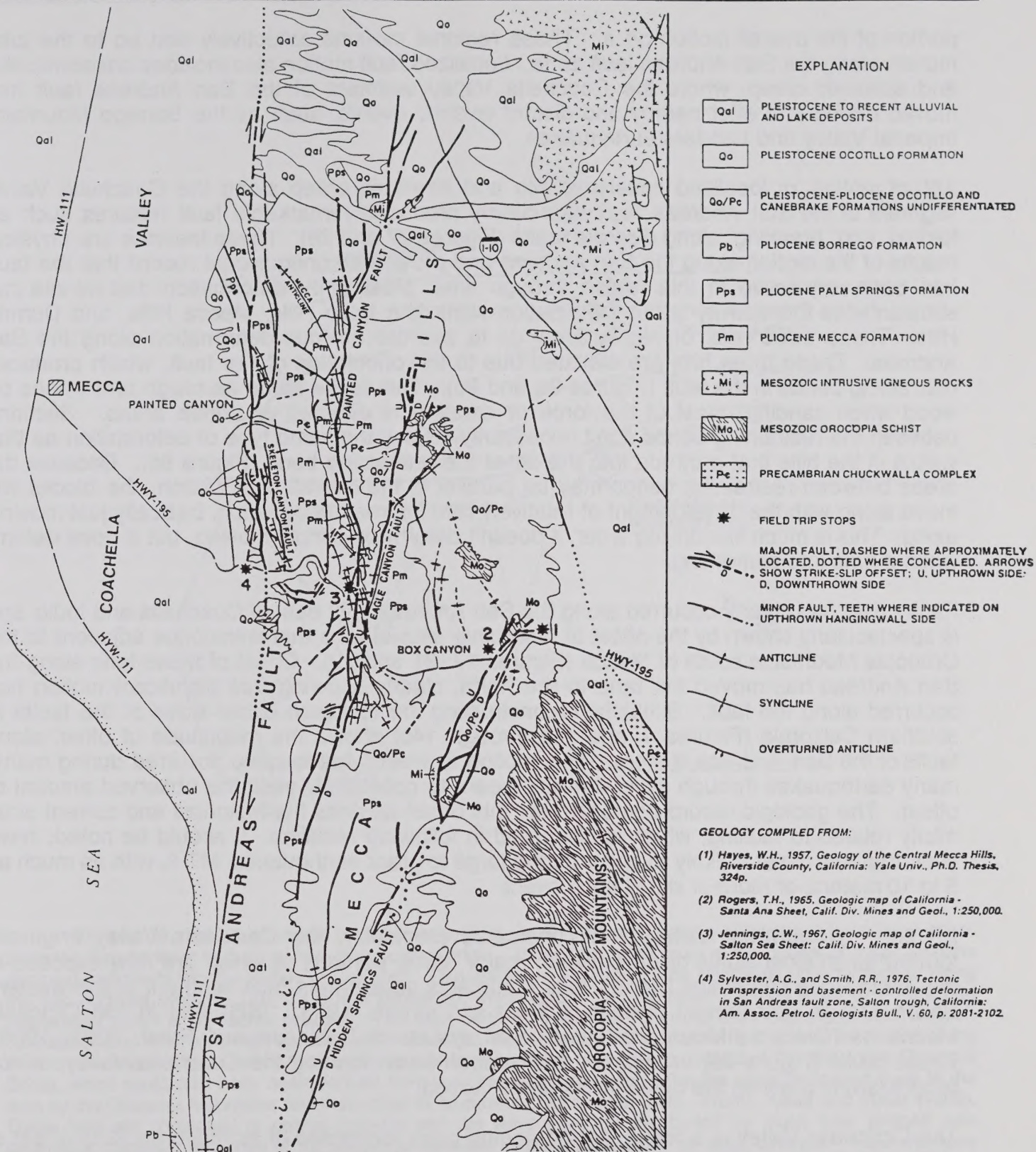


Figure 28. Geologic map of the Mecca Hills area showing the complexity of faulting along the San Andreas south and east of the General Plan Area. This area has world-class exposures of major strike-slip faulting and represents a unique resource to the city of Coachella. Deformation away from the main trace of the San Andreas points out that movement during an earthquake will be on a zone of deformation, not a single fault surface. Modified from: Norris 1994.

portion of the overall motion on it. These regional motions collectively add up to the total motion along the San Andreas fault zone. Localized fault motion also includes coseismic slip and aseismic creep, where the Coachella Valley segment of the San Andreas fault has moved during and after nearby and distant seismic events, such as the Borrego Mountain, Imperial Valley and Landers earthquakes.

Abrupt motion, or localized coseismic slip and aseismic creep along the Coachella Valley segment of the San Andreas fault has clearly produced remarkable fault features such as folding and breaking along discrete faults (Figures 27 and 28). These features are physical results of the motion along the San Andreas and provide an unequivocal record that the fault has been very active in this region through time. Most of the deformation that we see that substantiates this activity is the deformation within the Indio Hills, Mecca Hills, and Durmid Hills. These three hills, or highs, allow us to see the obvious deformation along the San Andreas. These three hills are elevated due to the orientation of the fault, which produces restraining bends in the fault (Figures 9a and 9c). This is the same as rough protrusions on wood when sanding; most of the force of sanding is directed on these areas. Sections between the restraining bends don't necessarily display the same type of deformation as that visible in the hills that protrude into the air at the restraining bend (Figure 9c). Because the areas between restraining bends may be parallel to the overall fault motion, the blocks will move along with the development of relatively little internal deformation, basically just moving along. This is much like driving a car, it doesn't deform by simply moving, but it does deform when it runs into something.

Fault offset has clearly occurred along the San Andreas fault east of Coachella and Indio and is spectacularly shown by the offset of distinctive alluvial fans that were once adjacent to the Orocopia Mountains south of Mecca (Figures 17, 21 and 29). Offset of these fans along the San Andreas has moved the fans to the north, clearly showing that significant motion has occurred along the fault. Similarly, reconstructing the rocks on either sides of the faults in southern California (Figures 4, and 14a through 14c) shows the magnitude of offset along faults of the San Andreas system. This motion is interpreted to have occurred during many, many earthquakes through several million years to collectively yield the observed amount of offset. The geologic record demonstrates this offset as does the historical and current seismicity related to faulting, which is discussed in following sections. It should be noted, however, that this offset is likely to occur during large to great earthquakes, M7-8, with as much as 5 to 10 meters, or more of slip at each event.

2.1.2.3 Coachella Valley. As indicated previously, the Coachella Valley originally formed as an extensional basin between major faults, portions of which are now exposed in the Santa Rosa Mountains (Santa Rosa Mountains detachment fault segment of the western Salton Trough detachment system of Frost and others, 1993, 1996) and in the Orocopia Mountains (Orocopia Mountains detachment system of Robinson and Frost, 1991, 1996). These faults (Figure 28) produced a half graben basin forming the Coachella Valley, which progressively grew as the detachment faults moved.

The Coachella Valley is a broad, gently sloping plain comprised of as much as 12,000 feet of sediments that are filling the Salton Trough structural low. These sediments (Qt, Qlso, Qo, Qpu, QTpa, QTpl, QTps, TQb, and TQm) are derived from the adjacent mountains, Gulf of California, Colorado River and wind blown deposits from the Palm Springs area to the northwest. Rocks exposed at the surface in the valley consist almost entirely of reworked sediments of very young ages (Qpl and Qs units on Generalized Geologic Map, Figure 5). These

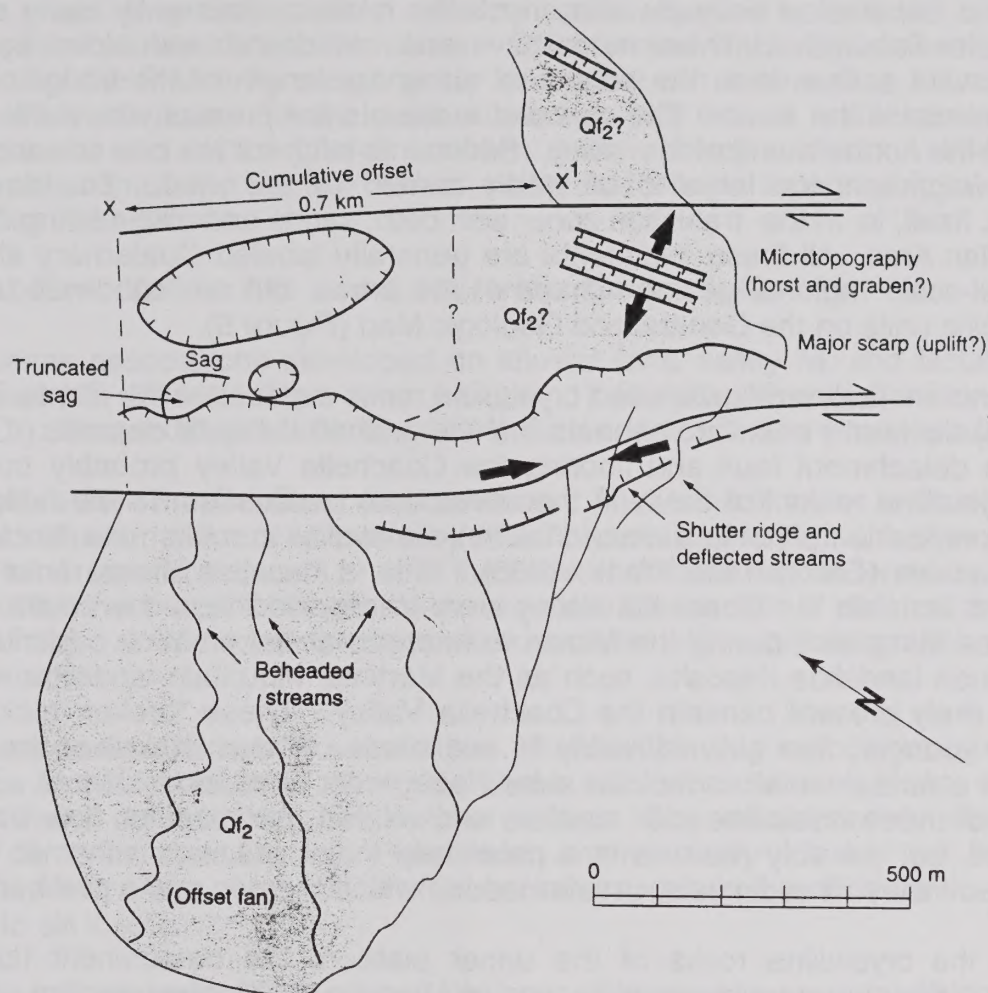


Figure 29. Idealized model of deformation in the Indio Hills area, where alluvial fans have been offset along the San Andreas fault away from their point of origin. These fans were once at the outlets of major streams dumping sediments into the Salton Trough area. They have been moved to the northwest (left) by motion along the San Andreas system. This fan is now beheaded, which means that the main drainage leads to a truncated headwaters (there is no source present). The area north of Interstate 10 in the Indio region consists of such beheaded fans, which originally formed near Mecca and were transported to the north and west by motion along the San Andreas. Clasts within the fanglomerates forming these fans are composed of the distinctive Orocopia Schist, which could only have been derived from the Orocopia Mountains. The fan must be moved back to the area by the Orocopia Mountains and then offset to its current position near Indio. From: Keller and Pinter (1996). These fans are composed of coarse material and are surrounded by and buried by much finer grained lake sediments. Seismic response of the fanglomerates and lake sediments will be quite different. Fans will have almost no liquefaction potential because of their extremely coarse-grained character, where fine-grained sediments may have considerable potential. However, the alluvial fans may have very major water-induced compaction problems, like in Death Valley where the addition of water to previously unconsolidated materials causes them to settle. The fans also allow surface water to percolate into subsurface aquifers. This is much like pouring liquid into a glass of ice; it can cause the ice to collapse and settle as the water enables the cubes to respond to gravity and settle to the bottom of the glass (until it again floats).

sediments have largely been redistributed by wind to produce a thin veneer of well sorted sands and clays that make a frosting-like cover for the Coachella Valley. The last high-stand of Lake Cahuilla was about 300 years ago, when the southern part of the valley was inundated by a very shallow lake (Proctor, 1968). Lake sediments, probably mostly muds, were deposited in this shallow body of water, much like muds are currently being deposited in the much smaller Salton Sea. These muds have since dried and been blown by the wind. The prevailing wind pattern is to the southeast along the length of the trough, thus continually moving material to the south. The coarsest materials are present where the wind velocity is highest, at the northern end of the valley. Sediments left here are coarse sands that are composed of fragments too large to be easily carried by the wind. The downtown area of Coachella, itself, is in the transition zone with both sands and clays being deposited in the General Plan Area. All these sediments are generally labeled Quaternary alluvium (Qal) on most small-scale regional geologic maps of the area, but are subdivided into numerous, more specific units on the Generalized Geologic Map (Figure 5).

The detachment fault and juxtaposed crystalline rocks exposed in the Santa Rosa Mountains (Figure 13) dip gently eastward beneath the fine grained valley fill deposits. Crystalline rocks above the detachment fault and flooring the Coachella Valley probably consist largely of broken crystalline rocks like those in the coves near La Quinta. These fairly uniform, intermediate composition plutonic rocks (tonalites) are similar to rocks near the top of the Santa Rosa Mountains (Erskine and Wenk, 1985). This is because these rocks such as at La Quinta and beneath the Coachella Valley were transported from the central to the western Santa Rosa Mountains during the Miocene extensional deformation. Similar broken rocks which include landslide deposits, such as the Martinez Mountain landslide west of the Plan Area, are likely present beneath the Coachella Valley. These "broken rocks" are currently buried by younger, fine grained valley-fill sediments. These broken rocks and landslides may exert a fundamental control on subsurface water flow and volumes. The subsurface geometry of these crystalline rock aquifers and related groundwater flow patterns is poorly understood, but possibly represents a potentially major resource either at the base of the fine-grained valley-fill sediments, or interbedded within them to make perched aquifers.

Overlying the crystalline rocks of the upper plate of the detachment fault beneath the Coachella Valley is an unknown thickness of Miocene to Pliocene coarse clastic rocks like those present around the margins of the range (Figure 4 and 5). These rocks are thought to be less deformed as those present in areas such as the Indio or Mecca Hills, where the San Andreas fault zone has severely disrupted the rocks. Rather, these buried sediments are more likely to still be largely undeformed and record the interfingering of alluvial fans and lake sediments in the center of the Valley. Interfingering of coarse and fine sediments produces a complex stratigraphic layering that is difficult to correlate from drill hole to drill hole. Interbedding of fine grained sediments such as clays within coarse alluvial fan material likely creates many isolated aquifers beneath the General Plan Area and the margins of the Coachella Valley. These sediments will also make the seismic response to earthquake waves fairly heterogeneous, although the alternating layers of coarse and fine material are thought to assist in damping seismic waves.

2.2 Soil Units (Soil Conservation Service Soil Series)

The principal soil units or soil series within the Coachella General Plan Area are described by the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) Soil Survey of Riverside County Coachella Valley Area (September 1980). In general, the development of soil profiles record the surficial weathering of the underlying rock and alluvial units.

The majority of soils found in the Coachella General Plan Area are developed from alluvial fans, valley fill, or lacustrine (lake) basins within the Coachella Valley. The remaining soils were developed over hilly terrain (Indio and Mecca Hills) and on old terraces (base of Santa Rosa Mountains) rimming the valley. Soils on alluvial fans and valley fill range from fine sands in dune areas; to gravely, cobbly, or stony sands adjacent to hillsides; and to sandy loams in the central portion of the Plan Area. Soils formed within lacustrine basins in the southern portion of the Plan Area are generally loams that can have a clay, silt, and/or sandy component to their character. Finally, soils situated on hilly terrain and terraces range from sands to loams and can exhibit gravely, cobbly, and/or clayey matrix. A brief, summary description of soils comprising the two distinct, valley and hillside topographic features within the General Plan Area follows.

2.2.1 Alluvial Fan, Valley Fill and Lacustrine Basin Soils

Soils or soil series associations developed on alluvial fans, valley fill, and lacustrine basins within the Coachella General Plan Area include: 1) Carsitas-Myoma-Carrizo, 2) Myoma-Indio-Gilman, 3) Gilman-Coachella-Indio, and 4) Salton-Indio-Gilman-Imperial associations.

2.2.1.1 Carsitas-Myoma-Carrizo Association. This soil formation is situated in deep, coarse textured alluvium influenced by valley fill. These soils are found on the perimeter of the General Plan Area and, adjacent to or at the base of, hilly terrain or terraces. Slopes are generally less than five percent but can be as steep as 30 percent in isolated areas. These soils are well drained due to a sandy composition, and can often contain gravel, cobbles and stones in their profile.

2.2.1.2 Myoma-Indio-Gilman Association. Soils within this association are formed on moderately fine to coarse textured alluvium. These soils are commonly deep, well drained, and generally found on less than five percent slopes. The association is situated in the northwestern corner of the General Plan Area and primarily located on the northern Coachella Valley floor. The composition of these soils ranges from sands (in dune areas), to sandy loams, to silt loams.

2.2.1.3 Gilman-Coachella-Indio Association. These soils are formed on medium to coarse textured alluvium located on the Coachella Valley floor and comprise a majority of soils situated within the General Plan Area. Soils of this association are very deep, well drained and found on slopes of less than five percent. The association is primarily comprised of fine sands, fine sandy loams, silt loams, loamy fine sands and very fine sandy loams.

2.2.1.4 Salton-Indio-Gilman-Imperial Association. This soil association is formed on fine textured lacustrine deposits of the old Lake Cahuilla modified by eolian (wind) and alluvial (water) deposits derived from adjacent mountains and fans located north and northwest of the ancient lake bed. These soils are also very deep, but poorly to well drained, and generally located on slopes of two percent or less. These soils are situated on the Coachella Valley floor in the south-central portion of the General Plan Area. Soil compositions include silty clay loams, fine sandy loams, and silt loams.

2.2.2 Alluvial Fan, Old Terraces, and Hilly Terrain Soils

Soils or soil series associations developed on alluvial fans, old terraces and hilly terrain rimming the Coachella General Plan Area include: 1) Chuckwalla-Badlands, and 2) the Badlands-Carsitas associations.

2.2.2.1 Chuckwalla-Badlands Association. This soil association is generally located in the northeast to east portion of the General Plan Area within the Indio-Mecca Hills. These soils are formed on older alluvial fans deposited by streams and drainage channels from northerly watersheds. These very well to well drained soils have sandy loam to sandy clay loam textures with cobbly and/or gravely components. Side slopes range from two to 75 percent, with some very deep loam soils adjacent to very shallow sandy loams that have been severely eroded.

2.2.2.2 Badlands-Carsitas Association. This soil association is generally formed on sandy and gravely alluvial deposits situated within the drainage channels and steep walled ravines of the Indio-Mecca Hills. These soils are generally located on the eastern perimeter of the General Plan Area and tend to be very shallow except along stream channels or southwesterly trending drainages. Soils are excessively drained and primarily consist of sand with occasional gravel and cobbles. Side slopes are generally greater than nine percent within a majority of soils of this association.

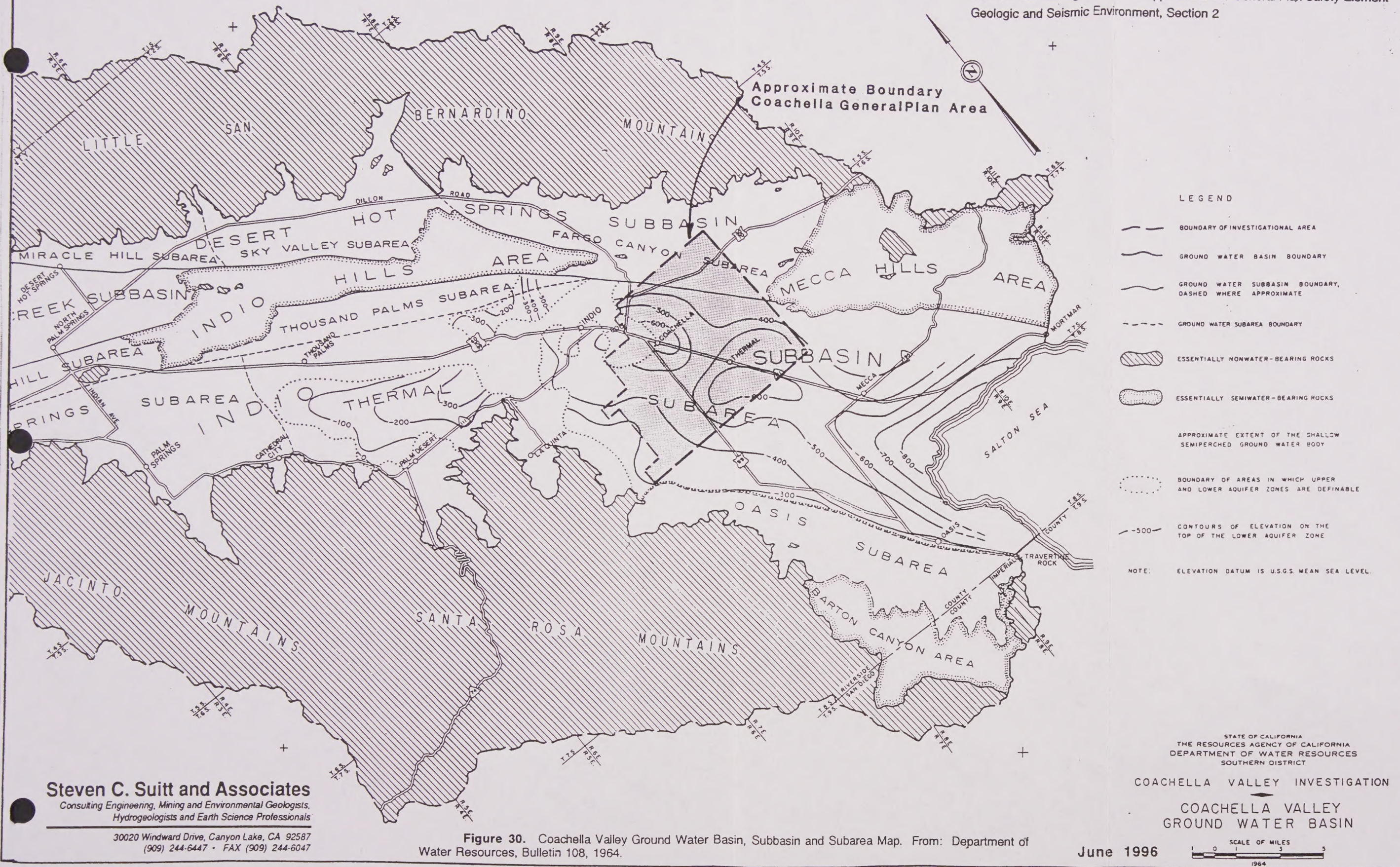
2.3 Hydrogeology

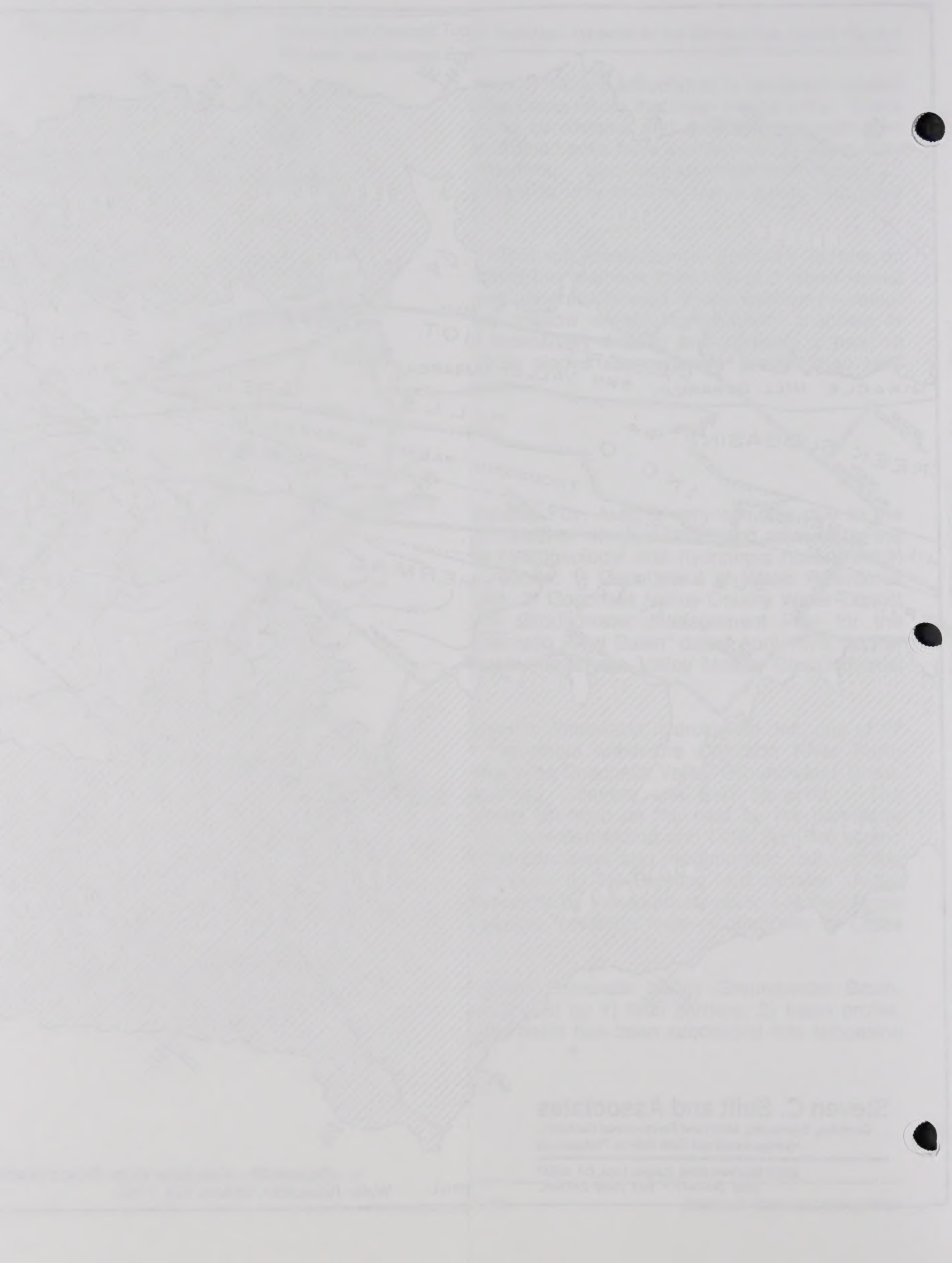
2.3.1 Hydrogeologic Setting

The hydrogeologic setting of the Coachella General Plan Area is very complex due to the various physiographic and subsurface geologic features situated within and adjacent to the Coachella Valley. Most information regarding hydrogeologic and hydrologic history within the General Plan Area is contained in three reports: 1) Department of Water Resources "Coachella Valley Investigation" dated July 1964; 2) Coachella Valley County Water District and Desert Water Agency "Coachella Valley Groundwater Management Plan for the Coachella Valley Planning Area of the West Colorado River Basin" dated April 1979; and 3) the Coachella Valley Association of Governments "Coachella Valley Master Environmental Assessment" dated August 1980.

In general, the Coachella Valley is located within the Whitewater hydrological unit, one of 27 hydrologic units based on barriers to water movement within the Colorado River Basin Region. The Whitewater hydrological unit includes the Coachella Valley Groundwater Basin, and the bounding "subbasins" areas of Morongo, Shavers and San Gorgonio. The Coachella Valley Groundwater Basin is generally bounded on the east by the non-water bearing crystalline and metamorphic rocks of the San Bernardino and Little San Bernardino Mountains, on the west by the non-water bearing crystalline and metamorphic rocks of the Santa Rosa and San Jacinto Mountains, on the north by the Banning fault situated on the north side of the San Gorgonio Pass, and on the south by the southerly portion of the Mecca Hills and northerly shoreline of the Salton Sea and travertine rock - Community of Oasis area.

There is groundwater flow throughout the entire Coachella Valley Groundwater Basin. Groundwater movement within the basin is constricted by 1) fault barriers, 2) basin profile, and 3) areas of low permeability. Therefore, the basin has been subdivided into subbasins and subareas.





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2.3.2 Groundwater

Based on the subsurface features, the Coachella Valley Groundwater Basin has been divided into subbasins including the Mission Creek, Garnet Hill, Desert Hot Springs, and the Whitewater River (Indio) water bearing subbasins, and the Indio Hills, Mecca Hills and Barton Canyon semi-water bearing areas. Subareas within the Whitewater River (Indio) Subbasin include the Palm Springs, Thermal, Thousand Palms, and Oasis. Subareas of the Desert Hot Springs Subbasin are the Miracle Hill, Sky Valley and Fargo Canyon. The Coachella General Plan Area is situated within the Thermal Subarea of the Lower Whitewater River (Indio) and the Fargo Canyon Subarea of the Desert Hot Springs water bearing Subbasins and the Indio and Mecca Hills semi-water bearing areas (Figure 30).

2.3.2.1 Thermal Subarea. The Thermal subarea consists of an upper aquifer zone with a fine-grained alluvial cap and a lower aquifer zone generally separated by a 100 to 200 foot thick clayey aquitard. The lower aquifer, composed of Tertiary and Quaternary sedimentary units, is the most important source of water in the Coachella Valley Groundwater Basin. The top of the lower aquifer zone occurs at a depth of approximately 300 to 600 feet below ground surface, and based on well records available from the Riverside County Flood Control and Coachella Valley Water District, extends to depths of 1,000 feet below ground surface in the subarea. Groundwater from this portion of the Subarea primarily serves the lower valley. Due to the overlying aquitard, groundwater encountered by deep wells that penetrate the lower aquifer will be influenced by confining pressures. Groundwater encountered from depths exceeding 300 feet below ground surface in the lower aquifer will generally rise to the surface in the southern portion of the subarea and to within 20 to 40 feet below ground surface in the northern portion of the subarea. Based on available information, it appears that groundwater withdrawal from the lower aquifer is causing an "overdrafting" condition and a depletion of an important water resource to the lower valley area.

The upper aquifer is similar in lithology to the lower aquifer, except the subsurface materials are mostly comprised of Quaternary alluvium and sedimentary rocks and the aquifer is less extensive vertically and laterally. Capping the upper aquifer is a shallow, fine grained silt, clay and sand zone where semi-perched and perched water is present to within five feet of the ground surface in many areas of the Plan Area. The maximum depth of the capping material is approximately 100 feet in some areas, and based on the fine grained sediments, is an effective barrier to deep percolation. Generally, groundwater is pumped from the lower aquifer, utilized for agriculture, domestic, industrial or commercial use, and discharged to the surface or shallow subsurface, which helps to maintain the shallow water levels. The low permeability of these capping materials with shallow ground water levels contributes to the agricultural irrigation drainage and liquefaction problems in the subarea.

2.3.2.2 Fargo Canyon Subarea. This subarea primarily consists of recent alluvium and Quaternary sedimentary deposits. Groundwater data within the available literature is sparse. Of nine wells performed in the subarea as part of the Department of Water Resources investigation, only two are active. Water levels measured in these wells as of 1961 indicated that groundwater was greater than 80 feet below ground surface. In this regard, well data is not sufficient to evaluate the configuration of the water table. Groundwater gradients and flow direction within the Fargo Canyon Subarea portion of the Coachella General Plan Area are anticipated to be gently sloping to the southeast, and may possibly be confined and restricted by splays of the San Andreas and related faults.

2.3.2.3 Indio and Mecca Hills Semi-Water Bearing Areas. The Indio and Mecca Hills semi-water bearing areas are generally underlain by Tertiary and Quaternary sedimentary and alluvial deposits. Faulting associated with the San Andreas and related faults, and the consolidated nature of the sedimentary and alluvial deposits has limited the extent of groundwater. Based on Department of Water Resources investigations, wells drilled in these areas were dry, abandoned, encountered water of poor quality or have indicated the presence of limited water supplies.

2.4 The Seismic Environment of the Coachella General Plan Area

2.4.1 Regional Faulting and Seismic Setting

Geologically, southern California is the site of a very famous plate boundary, the boundary between the Pacific Plate and the North American plate. This boundary is a complicated web of faults represented primarily on the surface of the earth as the San Andreas fault system, a series of northwest trending strike-slip faults. These northwest-trending strike-slip faults include the San Andreas fault (which is mapped continuously to the San Francisco Bay area), San Jacinto fault zone, the Imperial fault zone, the Elsinore fault zone, and a series of other strike-slip fault zones that generally parallel the trend of the San Andreas fault and even continue offshore of southern California. The Coachella General Plan Area lies in this tectonically active part of southern California, which is crossed by numerous active and seismogenic faults. The seismic history of southern California plays a major factor in the analysis of earthquake potential. The many active faults located in southern California have varying histories but are now linked to the motion between the Pacific and North American plates along the main trace of the San Andreas fault (GAM, 1992).

The Pacific plate is moving northwest, in a primarily horizontal right-lateral motion, past the North American plate at a rate of about 50 millimeters (2 inches) per year. About two-thirds of this motion (35 mm/year or 1.4 in/year) occurs along the San Andreas system of faults. Other fault zones located east and west of the San Andreas segment carry the remaining 35% of the motion (Jones, 1995; Working Group on California Earthquake Probabilities, 1995).

The northwest motion of the Pacific Plate relative to the North American plate in southern California is not everywhere parallel to the San Andreas fault. In fact, there is a "Big Bend" in the San Andreas fault in the area north of the Los Angeles Basin where the fault orientation restrains the lateral plate motion, and a great amount of compression has taken place to produce mountains such as the San Bernardino, the San Gabriel and the Santa Monica Mountains. Recent geologic studies have also realized the importance of the past structural history of southern California where many of the basins and hills have formed along detachment fault zones. Furthermore, detachment faults provide geologic structure that may allow direct linkage between major high angle fault zones that could enhance large earthquake clustering.

Extensional tectonics related to one such detachment fault zone formed the Coachella Valley and adjacent mountains prior to development of the modern-day San Andreas system. Portions of this previous episode of faulting and rock deformation are well exposed in the Santa Rosa and Orocopia Mountains, west and east of the General Plan Area. The gently inclined detachment fault exposed in the Santa Rosa Mountains (Figure 13) dips beneath the Coachella General Plan Area, as do the crystalline rocks above and below the detachment fault. These rocks moved apart from each other during Miocene time, ending their extensional movement at about 12 million years ago, as judged from regional relationships (Blom

and others, 1988; Crowell, 1989; Stinson, 1991). This fault beneath the Plan Area is thought to be completely inactive (Suitt, 1994; M. Shafiqullah, pers. commun., 1989), simply recording motion prior to the development of the main strand of the San Andreas. Offset on this fault led Sharp (1972) to draw in a hypothetical fault through the Coachella Valley to explain the uplift of deep-crustal rocks present in the Santa Rosa Mountains against the valley floor rocks of shallow-crustal origin. His observation was extremely astute and correct; it is now recognized, however, that this juxtaposition is due to motion along the western Salton (Sea)Trough detachment system (Blom and others, 1988; Frost and others, 1993, 1996). Because this inferred fault has no surface exposure, no known subsurface expression or water barrier, no gravity signature, and no identified seismicity, it has been suggested that this hypothetical fault be abandoned from the literature (Frost and others, 1996). The nature of the juxtaposition for which the fault was proposed is completely explained by the Santa Rosa Mountains portion of the western Salton Trough detachment system (Frost and others, 1993, 1996) described in previous sections.

Furthermore, seismicity within the Coachella Valley is conspicuously absent as recorded by the Southern California earthquake net. The absence of seismicity beneath the valley proper is largely because the motion is being taken up by faults along the margins of the block, principally the San Andreas and San Jacinto faults. Motion on either of these bounding faults will likely produce significant ground motion throughout the entire block of the Coachella Valley. While direct rupture from strike-slip faults is not likely within much of the western Coachella General Plan Area, strong ground motion (shaking) produced by rupture on the "bounding fault" is a serious concern.

Classic outcrops of the San Andreas Fault, recorded in many textbooks and published reports, occur in the Mecca Hills, within an area varying between 5 and 13 miles southeast of the city of Coachella downtown area. The San Andreas system of strike-slip faults, including easterly splays such as the Painted Canyon, Skeleton Canyon, Coachella Fan fault zone and the Indio Hills fault, has caused the greatest concern in terms of probable zones of future seismic activity. From 1984 to 1994, southern California has recorded more than 200,000 earthquakes, many of which were too small to be felt (Jones, 1995). Figure 31 shows epicenters of earthquakes in southern California recorded from 1934 to August of 1995 within a 100 km (62 mile) radius of the city of Coachella downtown area and represents approximately 111,000 earthquakes. Interestingly, no major earthquake has occurred on the main delineation of the San Andreas Fault since the 1857 (the Fort Tejon) earthquake (Jones, L.M., 1995). Most of these earthquakes have occurred on parallel strands of the San Andreas Fault system or on buried "flat" faults, termed thrust or detachment fault depending on the specific location.

Strike slip faults, such as the San Andreas "system" of faults, are defined where the primary motion between blocks of rocks on either side of the fault is horizontal. Right-lateral strike-slip motion means that the rocks on the opposite side of the fault move to the right. Left-lateral strike-slip motion means that the rocks on the opposite side of the fault move to the left. With few exceptions, reverse faults, thrust faults, normal faults, and detachment faults are defined where the primary motion between blocks of rocks on either side of the fault is perpendicular to the fault trace, which requires a substantial vertical component. Since nature is not as clear cut as we may like, a combination of vertical and horizontal motion usually accompanies an earthquake. For example, during the 1992 Landers earthquake which was felt in the Coachella Area, the maximum surface rupture occurring on the Emerson fault was approximately 16 feet of horizontal right-slip motion and approximately 3 feet of

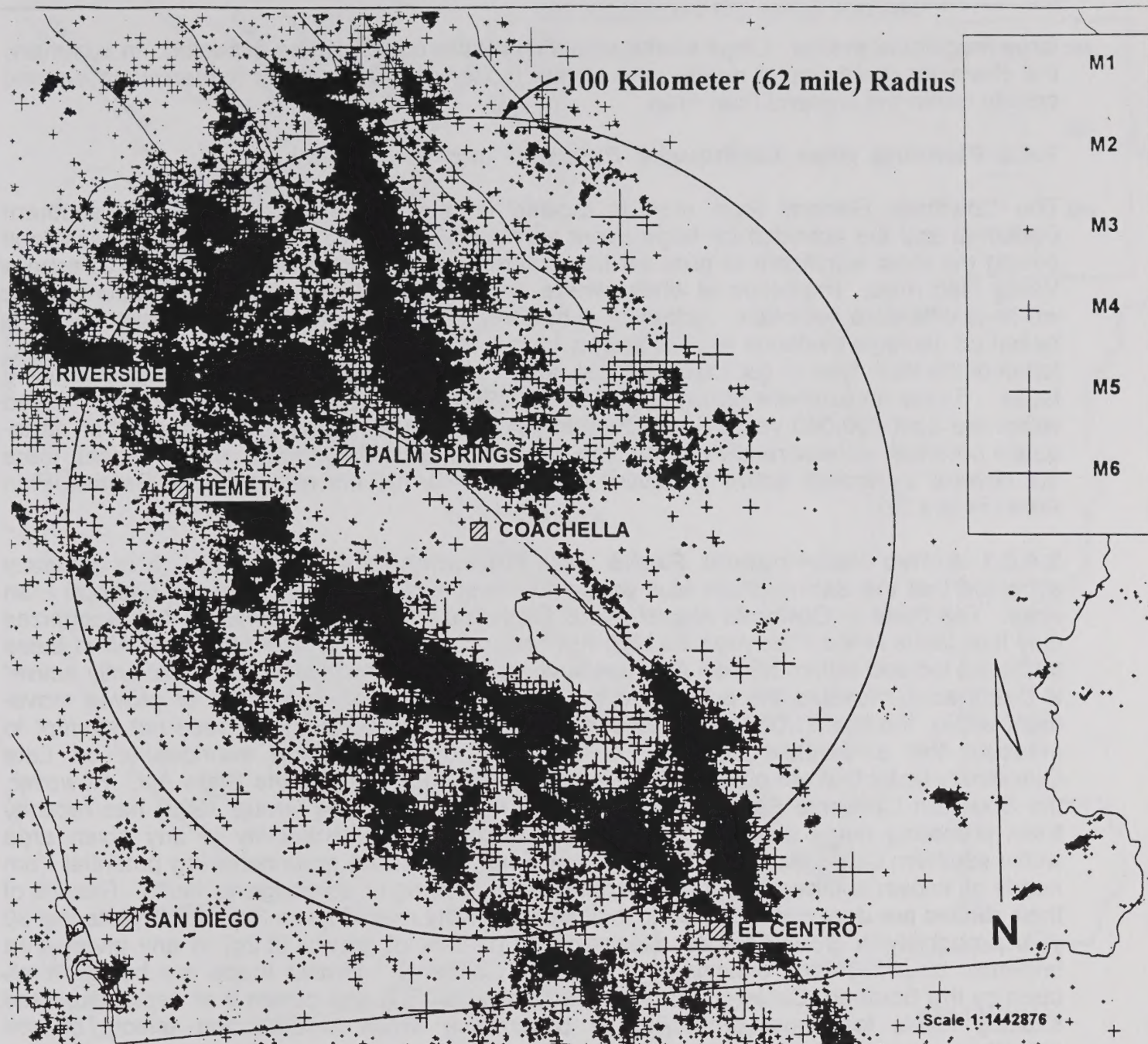
vertical motion (Hart and others, 1993). The primary displacement was horizontal and occurred on a strike-slip fault. The above descriptions are general but are intended to clarify some terms that will be discussed in this document.

2.4.2 Character of Seismicity

Tectonic earthquakes, in contrast to volcanic earthquakes which are caused primarily by normal stresses (i.e. volume changes, explosions), are caused by intermittent slippage or sudden slip on any pre-existing surfaces, such as a faults, that are subjected to a shear stress. Within the General Plan Area, these stresses are thought to be the result of movement of tectonic plates, the North American and Pacific. Large earthquakes may have surface fault rupture (i.e. 1857 San Andreas) or they may occur on or within entirely subsurface features, such as blind thrust or detachment faults, as evidenced during the Northridge and Whittier earthquakes. In general, most large damaging earthquakes have occurred along or are concentrated near major known faults mapped at the surface or within the shallow subsurface. This is evidenced by the alignment of earthquake epicenters primarily along, or parallel to, but slightly offset from, the surface trace of a fault.

Earthquake epicenters tend to form "shotgun" patterns along blind thrust type faults due to their somewhat, near horizontal orientation, and also because deformation is distributed within the "hanging wall" block. The epicenter of an earthquake is a point on the earth's surface directly above the focus, which is the location of the earthquake starting point below the earth's surface. Commonly, most earthquakes in southern California occur at a depth of 4 to 10 miles below the earth surface. The size or magnitude of earthquakes is typically controlled by a number of factors, such as the length of a fault or fault plane, the location of the fault in relationship to adjacent faults, the configuration and composition of the subsurface geology, slip rate, and the time since the last earthquake event. Additionally, the average time between earthquakes on a given fault or system of faults, in conjunction with the slip rate, will often constrain the magnitude of an earthquake over a specific period of time. Figure 32 depicts the major surface faults with selected historical earthquakes within close proximity to the General Plan Area that could influence seismicity in the Coachella Valley.

Not all fault slip is seismogenic, or capable of generating damaging ground motion. Some faults form as a product of sympathetic movement from rupture or motion transfer between different and adjacent faults. And yet, some fault slip may be triggered by distant earthquakes. Cascading or coseismic slip along several segments of nearby or adjacent faults adds another dimension to earthquake activity or the groundshaking threat to the General Plan Area. Coseismic slip occurred with the 1992 Landers earthquake, where adjacent faults previously presumed to be separate structures ruptured generating a larger earthquake than expected for individual segments. The Coachella segment of the San Andreas fault experienced minor coseismic slip of a few millimeters during or after the Landers event. Aseismic slip or fault creep, (i.e. surficial movement that progresses with negligible seismic wave generation), may also influence fault hazards in the General Plan Area. Fault creep was documented on the Coachella segment of the San Andreas fault several days after the 1968 Borrego Mountain earthquake, and continued for several years. As indicated in Figure 31, it appears that the Coachella General Plan Area is situated in a "seismic gap", where a large or major earthquake has been anticipated, but has not occurred in historic time. Currently, there is no consensus as to the explanation of this "gap" feature. However, the observation that large earthquakes with major slip occurs on the Coachella Valley segment of the San Andreas fault suggest that through historic time the fault has a quiescent period between



EPICENTER SEARCH DATA SHEET

SITE LOCATION: 33.657 LAT. -116.172 LONG.

SCALE 1: 1442876

TIME PERIOD: 1932-1995

MAGNITUDE RANGE: 0.0- 8.9

DEPTH RANGE: -5 - 50 (km)

MINIMUM LOCATION QUALITY: C (~ 5 km)

TOTAL # OF EVENTS ON PLOT: 157801

SEARCH RADIUS: 100 KILOMETERS

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 111315

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

0.0- .9 : 21917
1.0- 1.9 : 63080
2.0- 2.9 : 21128
3.0- 3.9 : 4536
4.0- 4.9 : 584
5.0- 5.9 : 61
6.0- 6.9 : 8
7.0- 7.9 : 1
8.0- 8.9 : 0

CLOSEST EVENT: 3.0 ON SUNDAY, MARCH 01, 1942 LOCATED APPROX. 1.1 KILOMETERS FROM THE SITE

LARGEST 5 EVENTS:

7.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 65 KILOMETERS NORTHWEST OF THE SITE
6.5 ON SATURDAY, DECEMBER 04, 1948 LOCATED APPROX. 36 KILOMETERS NORTHWEST OF THE SITE
6.5 ON WEDNESDAY, OCTOBER 21, 1942 LOCATED APPROX. 78 KILOMETERS SOUTH OF THE SITE
6.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 85 KILOMETERS NORTHWEST OF THE SITE
6.4 ON TUESDAY, APRIL 09, 1968 LOCATED APPROX. 52 KILOMETERS SOUTH OF THE SITE

Seismicity 1932-1995 (Magnitude 0.0+) 100 kilometer radius

Coachella General Plan Area

Figure 3 1

June 1996

Seismicity Map

Steven C. Suitt and Associates

Consulting Engineering, Mining and Environmental Geologists,
Hydrogeologists and Earth Science Professionals

30020 Windward Drive, Canyon Lake, CA 92587

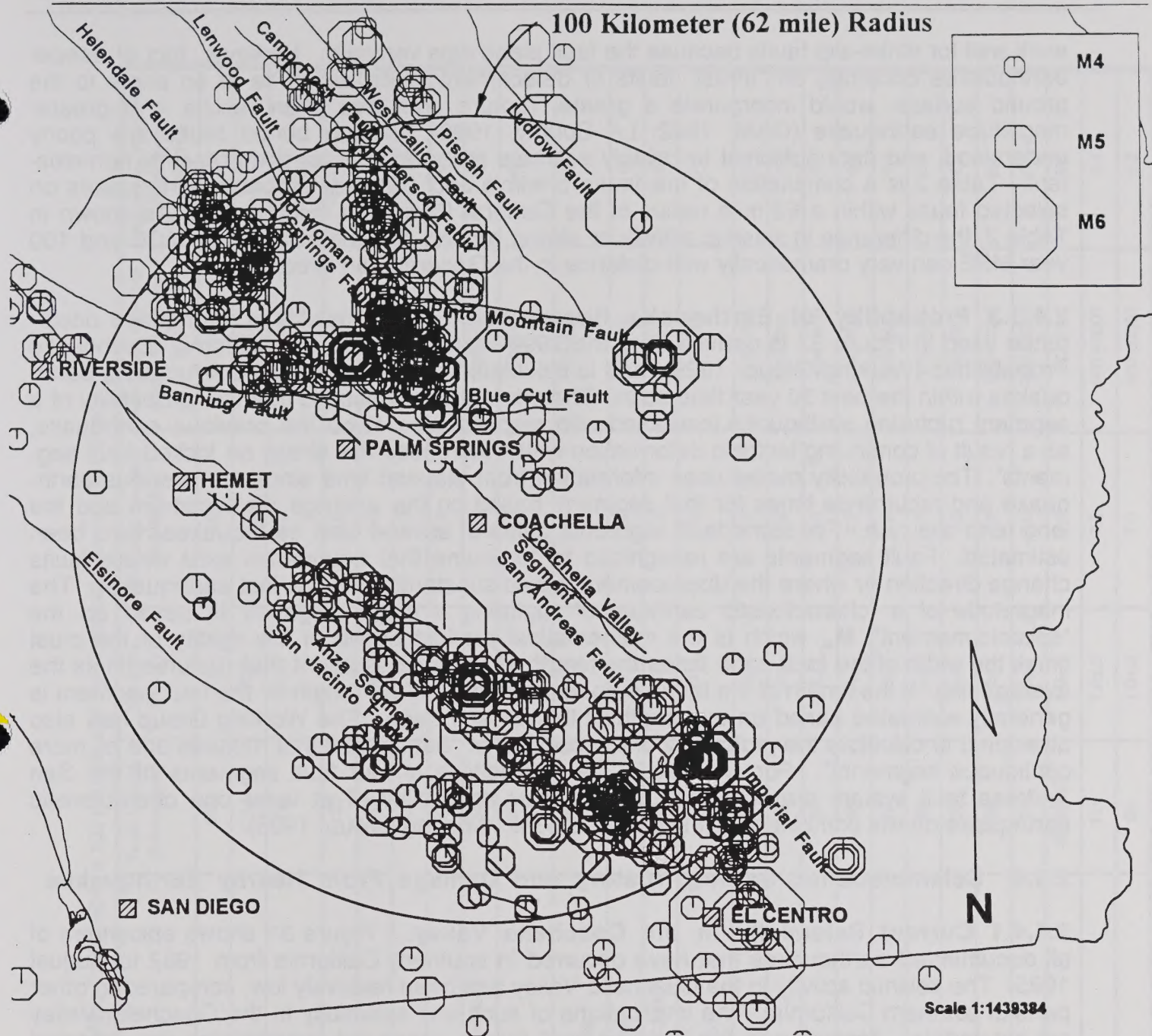
large magnitude events. Large earthquake aftershocks could also be expected. In summary, the character and types of nearby and distant faults will have a major influence on seismic activity within the General Plan Area.

2.4.3 Planning Area Earthquake Potential and Probability

The Coachella General Plan Area is located in a seismically active area of southern California and the potential for large event earthquakes is high, with the San Andreas fault posing the most significant or greatest risk in terms of ground shaking within the Coachella Valley Plan Area. Prediction of when, where and how large the next damaging earthquake will be is difficult to ascertain. Judgment of how often and how large an earthquake will be is based on geologic evidence of past events, historical seismicity, the dimensions and configuration of the fault, type of geologic material, and its relation to nearby earthquake-producing faults. Some researchers (Ziony and Yerkes, 1985) contend that faults that have moved within the past 750,000 years (Late Quaternary) possess a relatively high degree of earthquake potential, at least relative to the time frame of most development. In this regard, there are several "potentially active to active" faults within a 100 km radius of the General Plan Area (Figure 32).

2.4.3.1 Active Seismogenic Faults and Groundshaking Potential. It is generally accepted that the San Andreas fault poses the most significant hazard to the General Plan Area. The State of California Alquist-Priolo Earthquake Fault Zone (APEFZ) Act recognizes only four faults in the Plan Area as high risk "active" faults for rupture potential. All of these faults are located within the San Andreas fault zone. The term "active" or "sufficiently active" is designed to measure the potential for surface rupture using suspected or proven movement within the last 11,000 years as a yardstick. The APEFZ program does not attempt to measure the earthquake potential, or likelihood of a damaging earthquake, on Late Quaternary faults that are either acknowledged or unrecognized by the State Act. However, the Southern California Earthquake Center (Aki, et. al., Working Group 1995) has recently been preparing maps depicting the earthquake potential or probability in any given area within southern California. The Working Group has generated groundshaking potential from nearly all known southern California earthquake producing or seismogenic faults. Results of their studies are depicted in a groundshaking probability map (Figure 33), which plots the 30 year probability of ground motion exceeding 20 percent of gravity (0.2g) in any given area underlain by similar rock conditions of southern California. Similar maps are being developed by the Southern California Earthquake Center (SCEC) and others that depict expected shaking levels for equal probability of occurrence which includes the effects of soil conditions.

2.4.3.2 Maximum Credible and Maximum Probable Earthquakes. Although much of our present understanding of earthquake histories on specific fault zones is still relatively qualitative, there has been an attempt to standardize and quantify potential risks from a specific fault zone and earthquake. Maximum credible earthquakes (MCE) represent the largest earthquake expected on a particular fault zone in the current tectonic environment and typically involves rupture of the entire fault length. Maximum probable earthquakes (MPE) are the largest earthquakes likely to occur within a specified time frame, typically from 30 to 100 years. MPE's are used commonly in planning and design while MCE's are used in establishing safety margins for critical projects, such as hospitals and schools. Both the MCE and MPE are deterministic earthquakes. The MPE and MCE are calculated based on the most current estimate of slip rate, and the known length of the fault zone. This method may



EPICENTER SEARCH DATA SHEET

SITE LOCATION: 33.667 LAT. -116.172 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 1047

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 662

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

4.0-4.9: 583
 5.0-5.9: 60
 6.0-6.9: 8
 7.0-7.9: 1
 8.0-8.9: 0

CLOSEST EVENT: 4.6 ON SUNDAY, OCTOBER 31, 1943 LOCATED APPROX. 9 MILES FROM THE SITE

LARGEST 5 EVENTS:

7.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 40 MILES NORTHWEST OF THE SITE
 6.6 ON SATURDAY, DECEMBER 04, 1948 LOCATED APPROX. 22 MILES NORTHWEST OF THE SITE
 6.6 ON WEDNESDAY, OCTOBER 21, 1942 LOCATED APPROX. 48 MILES SOUTH OF THE SITE
 6.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 63 MILES NORTHWEST OF THE SITE
 6.4 ON TUESDAY, APRIL 09, 1968 LOCATED APPROX. 32 MILES SOUTH OF THE SITE

Seismicity 1932-1995 (Magnitude 4.0+) 62 mile (100 kilometer) radius

Geologic and Seismic Environment, Section 2

Coachella General Plan Area

Figure 32

June 1996

Steven C. Suitt and Associates

Consulting Engineering, Mining and Environmental Geologists,
 Hydrogeologists and Earth Science Professionals

**M4.0 or Greater Seismicity
 and Major Fault Map**

work well for strike-slip faults because the fault plane dips vertically. However, foci of deeper earthquakes occurring on "thrust" faults or detachment faults, which lie at an angle to the ground surface, would incorporate a greater rupture area that often results in a greater magnitude earthquake (GAM, 1992; LA County, 1990). These buried faults are poorly understood, and data sufficient to reliably estimate recurrence times are presently non-existent. Table 2 is a compilation of maximum credible and 100-year probable earthquakes on selected faults within a 62 mile radius of the General Plan Area (Figure 32). As shown in Table 2, the difference in seismic activity or strong ground shaking from either MCE and 100 year MPE can vary dramatically with distance to the General Plan Area.

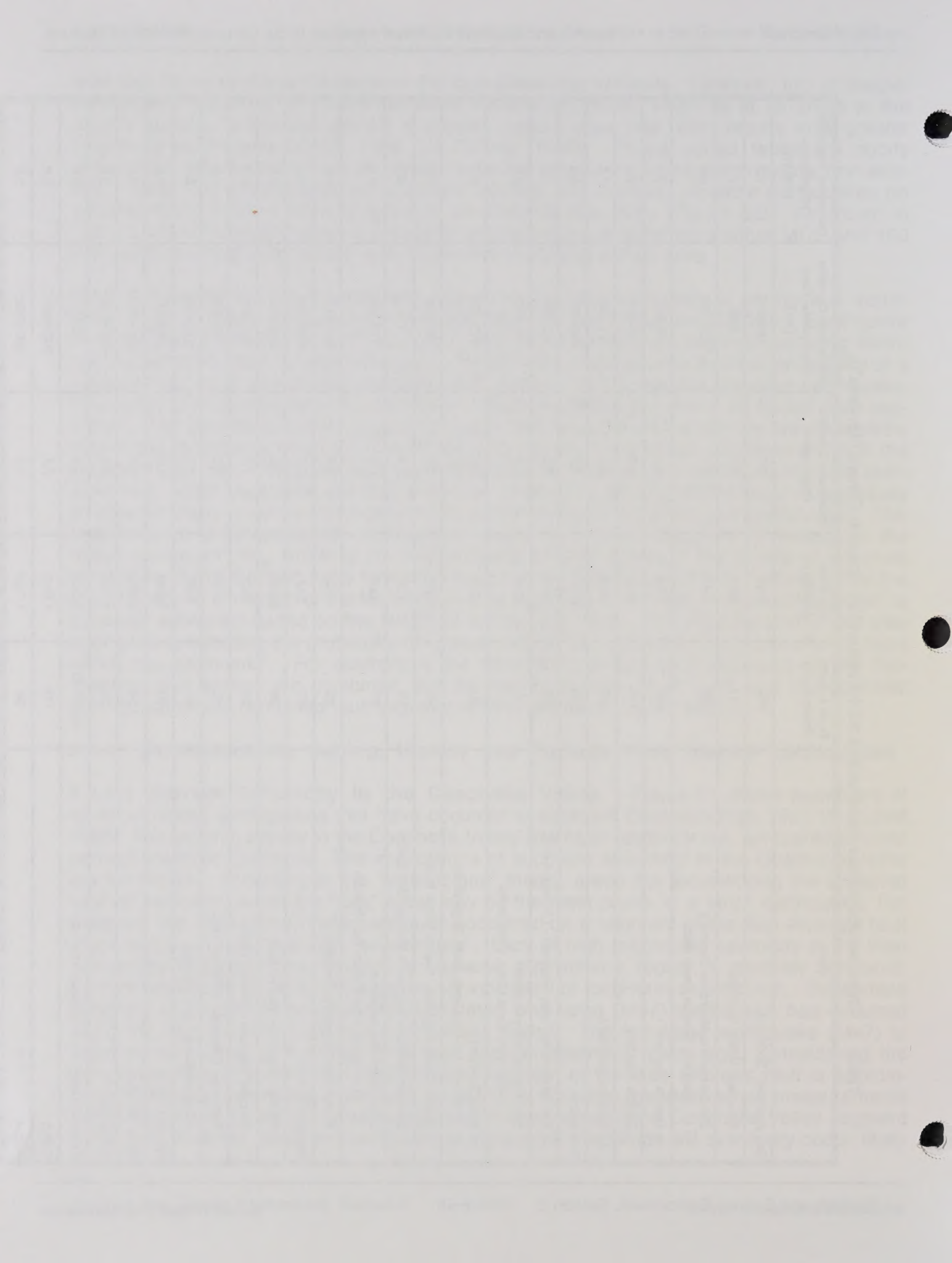
2.4.3.3 Probability of Earthquake Recurrence. The probability of earthquake occurrence used in Figure 33 is derived from the 1994 Working Group on California Earthquake Probabilities (Working Group, 1995), and is calculated for different segment-rupturing earthquakes within the next 30 year time span. The primary assumption is that the "probability of a segment rupturing earthquake increased with elapsed time since the previous earthquake, as a result of continuing tectonic deformation which increases the stress on locked fault segments". The probability model uses information from elapsed time since the previous earthquake and recurrence times for that segment, based on the average displacement and the long term slip rate. For some fault segments dates of several past earthquakes have been estimated. Fault segments are recognized to "presume that boundaries exist where faults change direction or where the displacement varied substantially in the last earthquake". The magnitude of a "characteristic earthquake" rupturing a single segment is based on the "seismic moment", M_0 , which is the mathematical product based on the rigidity of the crust times the width of the fault zone times the length of the fault segment that ruptures times the average slip. If the length of the fault segment is unknown, the length of the fault segment is generally estimated based on the length of the surface trace. The Working Group has also attempted to calculate the probability of a "cascade" or "earthquake that ruptures one or more contiguous segments". For example, if the interactions of four fault segments of the San Andreas fault system are combined, the 30-year probability of at least one characteristic earthquake on the combined fault segment is 53% (Working Group, 1995).

2.4.4 Seismotectonic Setting, History and Damage From Nearby Earthquakes

2.4.4.1 Current Seismicity in the Coachella Valley. Figure 31 shows epicenters of all documented earthquakes that have occurred in southern California from 1932 to August 1995. The seismic activity in the Coachella Valley has been relatively low, compared to other parts of southern California. The implications of such low seismicity in the Coachella Valley are not certain. According to the "seismic gap" theory, areas not experiencing the expected level of seismicity within the "gap" area, may be the most prone to a large earthquake. For example, the 1989 Loma Prieta earthquake occurred on a segment of the San Andreas fault which had been classified as a "seismic gap". Lack of high magnitude seismicity in the Plan Area today (Figure 31) may be due to aseismic slip within a region of relatively thin crust. Current seismicity, however, may not be an indication of long-term seismic risk. Subsurface trenching studies have indicated that more than one large ($M > 7$) earthquake has occurred along the San Andreas fault in the Coachella Valley. The last large earthquake ($M > 7$) to occur in the vicinity of the Plan Area was approximately 300 years ago. Considering the recurrence interval for the Coachella Valley segment of the San Andreas fault is approximately 220 years, and other data such as geologic slip rates, geodetic strain measurements and numerous large earthquakes along faults that connect to the Coachella Valley segment of the San Andreas fault, an earthquake of significant magnitude will eventually occur; likely

Table 2. Characteristics of Major Faults within a 100 km radius of the Coachella General Plan Area.

Fault	Fault Length (kilometers)	Slip Rate (mm/yr)	Maximum Credible Magnitudes	Maximum Credible Recurrence Time (yrs)	Maximum Probable Magnitudes (100-yr)
San Andreas - Southern	550	30±5	8.0	140-210	7.3
Coachella Valley Segment	114	30±5	8.0	220	7.1
San Bernardino Mountains Segment Banning, Mission Creek faults	78	24±3	8.0	106-133	6.9
Mojave Segment	133	30±8	8.0	79-273	7.1
Carrizo Segment	145	34±3	8.0	81-355	7.2
Cholame Segment	60	34±5	8.0	71-233	7.2
San Jacinto	230	12±5	7.5	85-250	6.8
San Bernardino Valley Segment - Claremont fault	35	12±6	7.0	85-250	6.5
San Jacinto Valley Segment Claremont, Casa Loma, Clark faults	45	12±6	7.5	85-250	6.5
Anza Segment Clark, Coyote Creek, Buck Ridge faults	90	12±6	7.5	105-571	6.7
Coyote Creek Segment - Coyote Creek fault	40	4±2	7.0	80-333	6.3
Borrego Mountain Segment - Borrego Mtn. fault	29	4±1	7.0	175	6.2
Superstition Hills Segment Superstition Hills, Elmore Ranch faults	27	4±2	7.0	117-650	6.2
Superstition Mountains Segment	25	4±2	7.0	283-1150	6.2
Whittier-Elsinore	200	5±2	7.5	250-700	6.5
Whittier Segment - Whittier fault	38	2.5±1	7.0	486-1400	6.0
Glen Ivy Segment - Elsinore fault	35	5±2	7.0	150-200	6.3
Temecula Segment - Wildomar fault	42	5±2	7.0	129-500	6.3
Julian Segment - Elsinore fault	65	5±2	7.5	215-630	6.4
Imperial	50	30±5	7.0	40-60	6.9
Pinto Mountain	30	2.5±2	7.3	250-4000?	6.0
Helendale	78	1.0±.7	7.0	600-5000?	5.8
Emerson-Camp Rock-Johnson Valley-etc.	86-30-55	1.0±.5	7.5	3000?	5.8
Calico	118	1.0±.5	7.5	600-4000?	5.8
Pisgah	69	1.0±.3	7.0	600-3000?	5.8



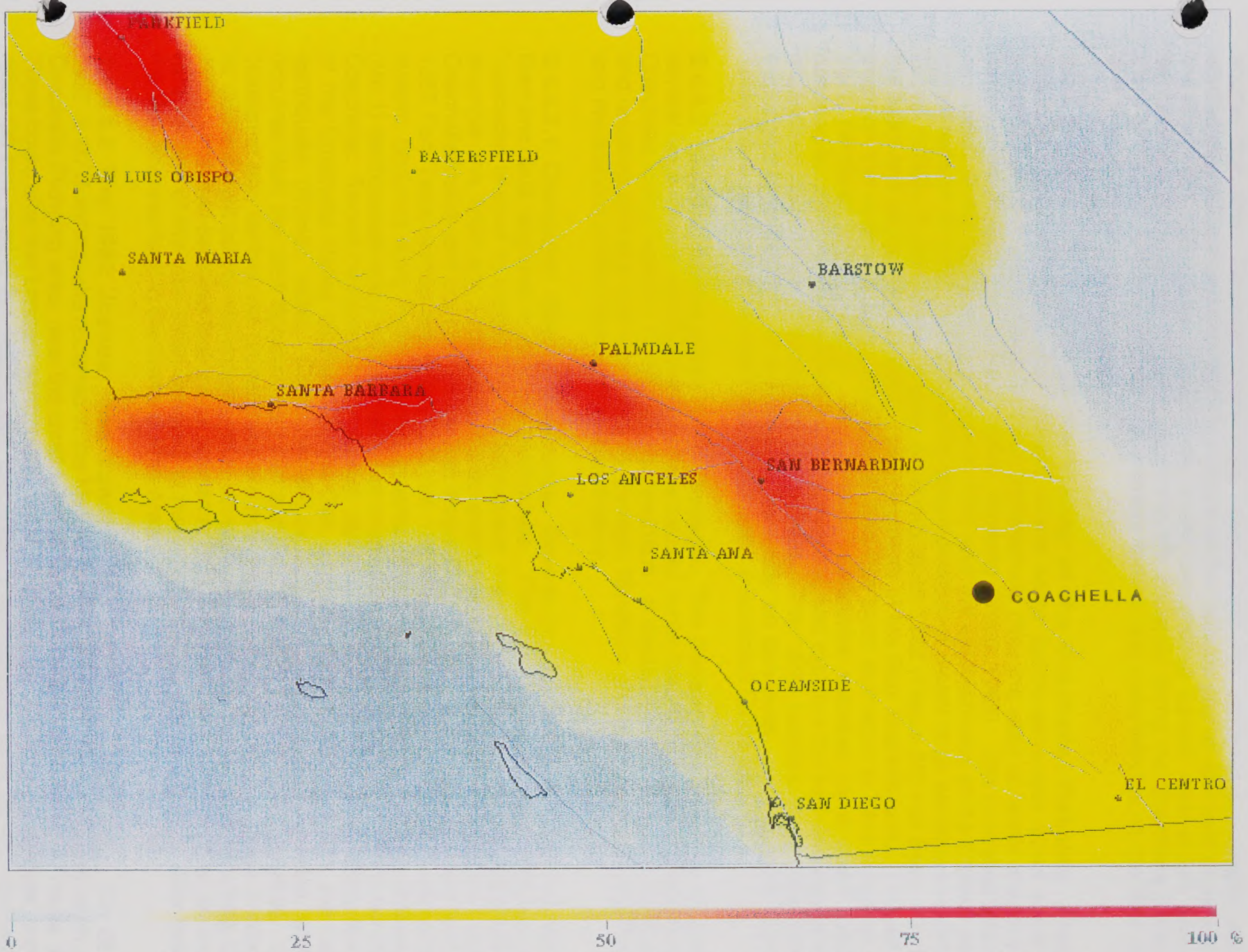


Figure 33. Ground shaking map depicting the 30-year probability of exceedance of 0.2g for the Southern California area.

sooner than later. Geothermal well data, seismic lines and additional subsurface trenching studies may be useful in assessing the nature of the "seismic gap" or low level of seismicity in the Coachella Valley area. Regardless of this unexplained current level of low seismicity, earthquakes of moderate to large magnitude are expected along the Coachella Valley segment of the San Andreas Fault and/or in areas surrounding Coachella (i.e. in the San Jacinto and Mojave areas).

2.4.4.2 Historic Seismicity in the Vicinity of the Coachella Planning Area. The historical record of earthquakes indicate where future earthquakes may occur since large earthquakes have been shown to occur preferentially near the sites of recent previous large earthquakes (Kagan and Jackson, 1994; Working Group, 1995). The increased population as a result of the California gold rush in 1849 and the establishment of the Caltech seismological network in 1932, has allowed for documentation of recent large earthquakes (Working Group, 1995). In the Coachella area, seismicity as of 1932 (Figure 31) has been very low in the basin and along the Coachella Valley segment of the San Andreas fault. The last main event on this segment using paleoseismic data has been estimated to have occurred about 1680 (Working Group, 1995). The largest earthquake recorded in southern California occurred in 1857, named the Fort Tejon earthquake, and ruptured the San Andreas fault for a distance of 360 km from Parkfield to Cajon Pass. The 1992 Landers earthquake provides evidence that earthquakes of large events may occur on previously unknown fault segments. Table 3 is a list of selected historical earthquakes in southern California.

2.4.4.3 Historic Earthquakes and Damage. The General Plan Area has experienced several large nearby earthquakes that have caused minor (less than 1 cm) movement on the Coachella Valley segment of the San Andreas fault. A discussion of the historic earthquakes and resulting damage from the Landers, Borrego Mountain and Imperial Valley earthquakes and implications to the General Plan Area follows.

2.4.4.3.1 Coseismic Slip or Cascades. Several past earthquakes have ruptured more than one fault segment in a single earthquake. The term coseismic slip, triggered slip or "cascades" is used to explain that an earthquake may rupture on contiguous segments. For example, the 1680 and 1450 paleoseismic event times at Indio may have ruptured both the Coachella Valley and the San Bernardino Mountains segment of the San Andreas fault. The 1857 Fort Tejon earthquake which ruptured 130 km segment along the San Andreas fault system, occurred along multiple fault segments. The 1992 Landers (M 7.3) and Joshua Tree (M6.1) earthquakes occurred on multiple strands of Mojave Desert faults, 25-30 miles north of Coachella. Recent coseismic (or triggered) slip in millimeters was observed along the trace of the Coachella Valley segment of the San Andreas Fault associated with the Landers earthquake (Rymer, 1994). Coseismic slip on this portion of the San Andreas fault also occurred from the 1968 Borrego Mountain and the 1979 Imperial Valley earthquakes. Due to coseismic slip, earthquake probabilities are now being calculated to incorporate characteristic displacement taking into consideration several fault segment interactions (Working Group, 1995). It should be noted that these coseismic (triggered) slip events amount to an insignificant fraction of the total strain believed to have accumulated during the past 300+ years on the San Andreas fault in the General Plan Area.

2.4.4.3.2 The 1992 Joshua Tree, Landers and Big Bear Sequence. On 28 June 1992, a M7.3 earthquake occurred in the Mojave Desert, about 50 miles (85 km) north of the Coachella Planning area, near the small town of Landers, just 6 miles north of Yucca Valley. Three hours after the Landers earthquake, a M6.6 aftershock occurred in Big Bear, some 18 miles (30 km) west of the main-shock epicenter. Seismographic data, as well as measured

affects on surface ruptures, indicate right-lateral strike-slip motion on north-northwest trending Camp Rock, Homestead, Emerson, and Johnson Valley faults. Surface rupture from the Landers earthquake was exhibited on these faults for a distance of 42 miles (72 km) and a maximum horizontal displacement of 22 feet (6.7 meters). Surface rupture was not evident from the Big Bear earthquake. Two months earlier, on April 22, a M6.1 earthquake occurred near Palm Springs, and ruptured towards Joshua Tree, considered now the Joshua Tree preshock to the Landers event. Joshua Tree is approximately 30 miles (50 km) north of the Coachella General Plan Area. Seismologists were surprised by several features of this 1992 sequence: a) the coseismic slip on several faults previously presumed separate structures, b) the large surface rupture, c) the M7.3 magnitude earthquake was larger than previously anticipated to occur on the separate individual fault segments, and d) the seismicity associated with the Landers sequence crossed the east-west trending, active Pinto Mountain fault (Hart and others; 1993; Topozada, 1993; Sieh and others, 1993). A Modified Mercalli Intensity Map of the Landers earthquake indicated a MMI of 5 for the area near the Salton Sea (Figure 34, Topozada, 1993).

2.4.4.3.3 The Borrego Mountain Earthquake of April 9, 1968 (M6.5). The epicenter of the Borrego Mountain Earthquake of April 9, 1968 (M6.5) occurred along the complex San Jacinto Fault zone, a member of the San Andreas Fault system, exhibiting right-lateral strike-slip motion. The epicenter of this earthquake was located approximately 35 miles south of the City of Coachella downtown area. The focus of this earthquake was located at a depth of approximately 11 km (7 miles). This was the ninth earthquake of greater than M6 to strike this area since 1915. The greatest horizontal right-lateral surface displacement accompanying this earthquake was 38 cm (15 inches) and occurred along the Coyote Creek fault branch, nearest the epicenter (Sharp, 1972; Allen and Nordquist, 1972). Surface faulting was evident along a 33 km segment of the Coyote Creek fault. The only precursory activity was a single foreshock of magnitude 3.7 that preceded the main shock by one minute. During the year following the main event, 135 aftershocks of M3.0 or greater were identified. One of the most interesting characteristics of this earthquake was the triggering of small displacements on several faults outside the aftershock area, including the San Andreas, and the bilateral faulting associated with the main shock (Allen and Nordquist, 1972). Surficial rupturing was identified along the Banning-Mission Creek, Imperial, and Superstition Hills, Coyote Creek faults and on the Coachella Valley segment of the San Andreas fault as a result of this one earthquake event.

Since the location of the Borrego Mountain earthquake was in a sparsely populated area, no human deaths were reported as a result of this earthquake. Modified Mercalli intensities of VIII-IX, however, were associated with the epicentral region. Topographical or terrain effects resulting from the ground shaking associated with the M6.6 shock included rockfalls, soil falls, slumps, ground cracking, dislodged pebbles and cobbles, shattered crusts overlying poorly indurated dry deposits, seismic compaction ruptures and sand boils. Structural damage was greatest in the epicentral area and in Salton City but was generally very light considering the magnitude of this event. Structural damage included cracked and spalled concrete bridge piers, broken and cracked concrete block walls, and unreinforced masonry walls that were toppled as far as 65 km (41 miles) from the epicenter. Terrain effects were observed as far west as in the city of San Diego, as far east as Brawley, as far south as El Centro, and as far north as Salton City. The most severe damage beyond the immediate area appeared to occur in the late Cenozoic lake deposits underlying most of the Imperial.

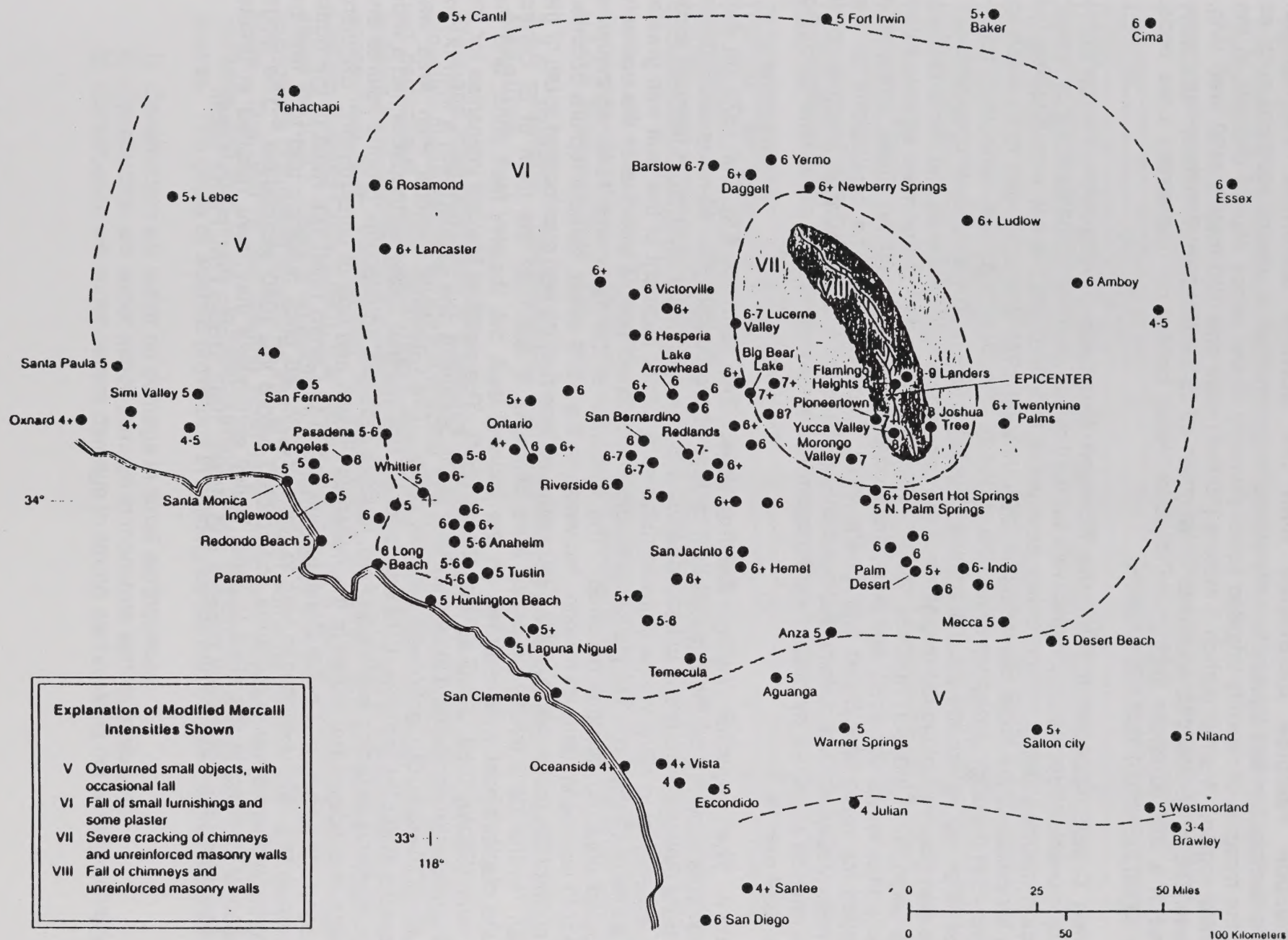


Figure 34. Preliminary Modified Mercalli Intensity map of the Landers earthquake, based largely on information from NEIC-USGS (Toppozada, 1993).

Liquefaction Features Associated With the Borrego Mountain Earthquake.

Seismic compaction and liquefaction effects were documented at several locations such as along the margins of recently irrigated fields, primarily in the sandy alluvial deposits in the epicentral region. A small graben 3 meters (10 feet) wide and 150 meters (492 feet) long, characterized by vertical displacements of as much as 15 centimeters (6 inches), was documented in a soaked alfalfa field in the Imperial Valley located on Quaternary Lake beds, some 30 km (19 miles) from the epicenter.

Seismic Creep Associated With the Borrego Mountain Earthquake. Fault creep is surficial movement usually associated with an earthquake event of magnitude 4.0 or less or abundant microseismicity. Fault creep associated with the 1968 event was documented along two-thirds of the initial displacement area through 1971 and amounted to as much as 50 percent of the original displacement (Clark, 1972). Creep in this 1968 earthquake represented "after slip" where the ground surface is trying to catch up with deeper coseismic slip. Creep also occurred along the segments of the Superstition Hills, Imperial and the Coachella Valley segment of the San Andreas faults. Observations following the main seismic event suggest that creep occurred suddenly days after the main event on these faults, and continued for years later (Allen and others, 1972; Ziony, 1985). The implications for the Coachella Valley are that surface displacements in the form of slow or sudden creep on local faults may be triggered by distant earthquakes and may continue for some time following large, local events.

2.4.4.3.4 The Imperial Valley Earthquakes. The 1940 (M 6.9) and 1979 (M 6.4) earthquakes occurred on the Imperial fault located approximately 70 - 80 miles south of the Coachella General Plan Area. In both these events, the same fault ruptured in identical locations, except that in 1940 the earthquake ruptured a longer segment of the fault with greater displacement (Table 3). The 1979 earthquake injured 73 people but due to the sparsely populated area, no fatalities occurred. The epicenter of the 1979 and 1940 earthquakes were both located in northern Mexico. However, in the 1979 event, surface rupture occurred only north of the border while in the 1940 event, surface rupture was also located south of the border. In the 1979 event, structures were damaged in and near the town of El Centro. Surface displacement was recorded on the Imperial fault, the Brawley fault zone, and the Rico fault. (Sharp, 1982, U.S.G.S. Prof. Paper 1254). The modified Mercalli intensities for the 1979 earthquake, indicated a maximum MMI at VII, excluding one location with a MMI IX) for Brawley, Calexico, El Centro and Imperial cities. The Coachella General Plan Area was assigned a MMI of V, from the 1979 earthquake. The Imperial Valley earthquakes had a wide range of effects including surface faulting, multiple ruptures, liquefaction, ground failures and damage to buildings that varied in the materials, design and age of construction. Excluding damage to the Imperial County Services Building in El Centro (MMI IX), most of the quake damage in the 1979 earthquake was to low unreinforced brick buildings and to a few low reinforced concrete-frame buildings constructed before the 1940 earthquake. The longer duration of shaking in the 1940 Imperial Valley earthquake may have resulted in greater damage during the 1940 event (Reagor and others, 1982, USGS Prof. Paper 1254).

Table 3.

The following are selected historical earthquakes in southern California and northern Baja California :

Earthquake	Date	Length Fault (Km)	of Duration Epicenter (seconds)	at Magnitude
Northridge	January 17, 1994	14	7	6.7
Big Bear	June 28, 1992	---	---	6.6
Landers	June 28, 1992	70	24	7.3
Joshua Tree	April 22, 1992	15	5	6.1
Upland	February 28, 1990	---	---	5.5
Superstition Hills	November 24, 1987	23	15	6.6
Whittier-Narrows	Oct. 1, 1987	6	3	5.9
Palm Springs	July 8, 1986	20	4	5.9
Imperial Valley	October 15, 1979	30	13	6.4
San Fernando	February 9, 1971	16	8	6.7
Borrego Mountain	April 9, 1968	25	6	6.5
Desert Hot Springs	December 4, 1948	---	---	6.0
Manix	April 10, 1947	---	---	6.2
San Geronio Pass	June 12, 1944	---	---	5.3
Imperial Valley	May 18, 1940	50	15	6.9
Laguna Salada	December 30, 1934	---	---	6.7
	December 31, 1934	---	---	7.1
Long Beach	March 10, 1933	15	5	6.4
San Bernardino-Loma Linda	July 23, 1923	---	---	6.2
Cerro Prieto	June 23, 1915	---	---	6
	November 21, 1915	---	---	7.1
E. San Bernardino Mountains	September 19, 1907	---	---	5.5 - 6
Lytle Creek - San Bernardino Mts.	July 22, 1899	---	---	6.5
Laguna Salada	February 23, 1892	---	---	>7
Fort Tejon	January 9, 1857	360	130	7.8
Cerro Prieto	November 29, 1852	---	---	6.5

Jones, L.M., 1995, Putting Down Roots in Earthquake County, handbook, Southern California Earthquake Center production, 28 p; and Stover and Coffman, 1993, Seismicity of the United States 1568-1989 (Revised), U.S.G.S. Professional Paper 1527.

2.4.5 Historic Development of Earthquake Legislation and Regulatory Measures

State and local legislation in California has increased with awareness of the importance of proactive measures to reduce the disaster and threat to human life that can be created during an earthquake. After each major earthquake California has experienced, planners and builders have learned of the successes and failures of different structures. These experiences have been incorporated into regulations for safety in building construction in the Uniform Building Code (UBC), first issued in 1927 by a non-profit, independent organization called the ICBO. There is an axiom, that "earthquakes don't kill, buildings do", indicating the importance of building structures that are capable of suffering minimal damage, and no loss-of-life. The goal of the building code is a 'minimum' standard for construction to avoid 'collapse' and loss of life. In fact, building codes expect damage to occur in strong earthquakes. The goals of seismic provisions in building codes can be summarized as follows:

- 1) Construction will suffer no damage in small earthquakes,
- 2) Construction will suffer minor damage in moderate earthquakes, and
- 3) Construction will suffer severe damage in strong earthquakes but will not collapse.

The high cost of repair to infrastructure from recent earthquakes such as the 1994 Northridge earthquake, estimated as over \$20 billion, has now brought the emphasis in building codes to also preserving expensive infrastructures during an earthquake (Fairweather, 1994). Future codes (year 2000) and planning recommendations as presented in the State of California Seismic Safety Commission (SSC) Northridge Earthquake "Turning Loss to Gain" summary will be performance-based to reduce damages to more "acceptable" levels during strong earthquakes.

Following the 1933 Long Beach earthquake where some 120 people perished, State legislation created the Field Act which mandated special seismic safety construction for new public schools. However, it was not until 1969 when the Garrison Act was passed by the State to address the retrofitting of pre-1934 school buildings, which had previously been exempt from the Field Act provisions. Following the 1971 San Fernando earthquake, the inadequacy of old building codes was further realized and new UBC seismic provisions were implemented by 1980. In addition, among other provisions, the Hospital Seismic Safety Act was made by the State, who assumes sole responsibility for structural review of other critical structures including dams, freeways and emergency facilities. The Alquist Priolo Earthquake Fault Zone Act (APEFZ) was also initiated in 1972 to attempt to regulate development in areas susceptible to surface fault rupture. Table 4 summarizes the following chronology of earthquake related legislation and UBC upgrades (LA County, 1990; Jones, L.M., 1995).

Table 4.

Chronology of the Uniform Building Code (UBC) and Earthquake Legislation for California.

Year	State/Local Level	National Level	Earthquake Event
1927	First Uniform Building Code (UBC), primarily about fire safety		
1933	Widespread Adoption of UBC		Long Beach (M6.4)
	Field Act: Public school construction becomes State responsibility		
1935	UBC requires foundation bolting and reinforcement of masonry foundations		
1939	Riley Act: State regulation of buildings larger than 2-family dwellings		
1946	UBC requires some reinforcement of masonry chimneys		
1959	Program for improvement of seismic codes in UBC by Structural Engineers Association of California (SEAOC)		
1969	Garrison Act: First Hazard Abatement effort		
1971	Inadequacy of building codes allows for reevaluation of UBC codes		San Fernando Earthquake (M6.7)
	Hospital Seismic Safety Act: Hospital construction becomes State responsibility		
	Safety and Seismic Safety Elements required in General Plan		
1973	UBC requires bracing of cripple walls		
1974	California Seismic Safety Commission established: Seismic Safety program development		
1977		National Earthquake Hazards Reduction Act (NEHRP) passed - establishes national program	
1978		Applied Technology Council (ATC) established to strengthen seismic codes. ATC 3-06 published and adopted in 1980.	
1979		Federal Emergency Management Agency (FEMA) established: lead agency for NEHRP program	
1980	Southern California Earthquake Preparedness Project (SCEPP) established: regional agency to coordinate local and State Hazard reduction programs		
1984	Bay Area Earthquake Preparedness Project (BAREPP) established		
1986	California Earthquake Hazards Reduction Act (CEHRA) passed - augments NEHRP		
	First Retrofit Law - State requires local governments to catalog unreinforced masonry buildings and develop a mitigation program		
1989	State requires all local governments to adopt same UBC		1987 Whittier-Narrows (M5.9)
1991	UBC increases bracing requirements for cripple walls and requires bracing of water heaters; retrofit of bridges; more stringent requirements for buildings on soft soil		1989 Loma Prieta (M7.1)
1993	State requires sellers of residential property to disclose seismic weaknesses to buyers		1992 Landers (M7.2)
	State adopts code regulating how retrofitting is done		
1994	New edition of UBC defines and limits use of conventional wood-frame construction; LA Emergency Provisions		Northridge (M6.7)
1997		UBC seismic provisions - major upgrade	

In addition, Federal and State governments enacted the 1977 National Earthquake Hazards Reduction Act (NEHRP) and the 1986 California Earthquake Hazards Reduction Act (CHRA) to ensure a more proactive effort in reducing seismic hazards. The goals of the CHRA (LA County, 1990) are as follows:

- Mitigation, including the expansion of scientific, engineering studies aimed at delineating and predicting geologic, seismologic hazards, and improving construction practices;
- Preparedness, including protection of critical facilities and dissemination of disaster preparedness education;
- Response, including integration of Federal, State, local plans and improvement in statewide communication systems; and
- Recovery, including military and financial relief for restoration of California's economy.

More recently, the Seismic Safety Commission's 1995 Northridge earthquake report entitled "Turning Loss to Gain", provided 168 recommendations regarding earthquake planning, construction and safety measures to the Governor of California for consideration. Those recommendations forwarded to the Governor relating to Achieving Seismic Safety Through Land Use Planning (specifically General Plans and Safety Elements), and Zoning, Subdivision, and Environmental Reviews include:

- California Division of Mines and Geology (CDMG) complete the Seismic Hazards Mapping Act program by 2005.
- Legislation be enacted requiring review of the Safety Element of general plans every five years to incorporate new information; the information in maps prepared under the Seismic Hazards Mapping Act (SHMA) should be incorporated within one year of the date final maps are provided to local jurisdictions.
- Legislation be enacted to make the existing optional CDMG review of safety elements mandatory for CDMG.
- Legislation be enacted to require that the safety elements of general plans address seismic vulnerability of existing building stock, or inventory, and contain risk-mitigation strategies. Description of the building stock should be included in enough detail to support the risk-mitigation strategy.
- Legislation be enacted to require CDMG to convene a high-level independent review board for the preparation and review of guidelines and maps prepared under the SHMA.
- CDMG work with local governments to establish a systematic program to ensure that the information provided by the SHMA program can be easily incorporated into general plans and zoning, subdivision, and environmental quality decisions.
- CDMG work with the Insurance Commissioner and representatives of the insurance industry to ensure that mapped hazard areas are not misinterpreted and used incorrectly in issuing insurance policies.
- CDMG and Office of Emergency Services (OES) support the preparation of damage scenarios, including localized scenarios and scenarios for areas of the state not presently covered.

- State of California Environmental Quality Act guidelines be amended to require that EIRs address seismic hazards, and engineering geologists and civil engineers, practicing within their areas of competence, review the hazards and proposed mitigation measures.
- Legislation be enacted to amend the Subdivision Map Act to require that geologic and geotechnical reports addressing seismic hazards be required for all major (five lots or more) subdivisions unless information is already available or until superseded by SHMA maps and that reports be reviewed by local government staffs or consultants with appropriate credentials.

Other recommendations were also forwarded by the SSC to the Governor for review in the area of Seismic Safety Through Land Use Planning. These recommendations pertained to the following areas: Alquist-Priolo Earthquake Fault Zoning Act, Inundation Mapping, Hazardous Materials, Historic Buildings, Redevelopment, Planning for Recovery, and Training. These recommendations can be reviewed in the City of Coachella Planning Office.

The Seismic and Geologic Technical Appendix to the safety element presented here is part of the proactive effort to identify the possible geotechnical and earthquake hazards for the Coachella General Plan Area.

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Section 3.0

Geologic and Seismic Hazard Analysis

The geologic and seismic hazard analysis is a critical component of the overall risk assessment. It involves the identification and evaluation of potential hazards that could affect the project. This includes the study of historical seismicity, geological structures, and the potential for future seismic events. The analysis also considers the impact of these hazards on the project and the surrounding area. By understanding the geologic and seismic hazards, the project can be designed and constructed to withstand these potential risks. The analysis is a key part of the overall risk assessment and is essential for the safe and successful completion of the project.

Section 3

Geologic and Seismic Hazard Analysis

Geologic Hazard

- Identification of geologic hazards, including faults, landslides, and erosion.
- Assessment of the potential for these hazards to occur and their impact on the project.
- Development of mitigation measures to reduce the risk of these hazards.
- Implementation of monitoring systems to detect any changes in the geologic conditions.

Seismic Hazard

- Identification of seismic hazards, including earthquakes and seismicity.
- Assessment of the potential for these hazards to occur and their impact on the project.
- Development of mitigation measures to reduce the risk of these hazards.
- Implementation of monitoring systems to detect any changes in the seismic conditions.

Earthquake Hazard

- Identification of earthquake hazards, including seismicity and ground motion.
- Assessment of the potential for these hazards to occur and their impact on the project.
- Development of mitigation measures to reduce the risk of these hazards.
- Implementation of monitoring systems to detect any changes in the earthquake conditions.

Other Hazards and Hazardous Materials

- Identification of other hazards, including landslides, erosion, and flooding.
- Assessment of the potential for these hazards to occur and their impact on the project.
- Development of mitigation measures to reduce the risk of these hazards.
- Implementation of monitoring systems to detect any changes in the other hazard conditions.

Section 3.0

Geologic and Seismic Hazard Analysis

The risk associated with certain geologic and seismic hazards, such as rain-induced flooding, various types of landsliding, ground shaking, surface rupture or liquefaction is often-times controlled by the frequency and duration of rain or thunder storms, the characteristics of nearby earthquake producing faults and fault zones, and the location and types of man made improvements. Terminology developed to estimate probable risk from these typical hazards, such as "100-year" flood and the "maximum probable" earthquake, emphasizes that there remains a certain amount of uncertainty regarding the scientific prediction of the timing and extent of damage expected from an earthquake or rainstorm. By gaining an understanding of the probable location and types of potential geologic and seismic hazards and impacts in the General Plan Area, suitable mitigation or management measures can be adopted and implemented. It should be noted, however, that the potential seismic related and geologic hazard maps referenced in this Seismic and Geologic Technical Appendix emphasize potentially hazardous locations only, and do not consider probability of occurrence.

In general, this section has been subdivided into five subsections based on known or potential geological, geotechnical and seismic conditions within or in the vicinity of the Coachella General Plan Area. Earthquake induced hazards are also considered. The following subsections are related to known or potential geologic and seismic conditions.

GEOLOGIC HAZARDS

- Erodability of soil and rock, including wind blown sand hazards,
- Slope Instability; such as: natural and man-made landslides, rockfall, and mud/debris flow,
- Subsidence (groundwater withdrawal),
- Collapsible soil,
- Expansive soils, and
- Percolation potential/Effluent disposal.

SEISMIC HAZARDS

- Surface rupture,
- Strong ground motion or shaking, and
- Earthquake induced ground failure, such as: liquefaction, lateral spreading and slope instability.

EARTHQUAKE INDUCED FLOODING

- Tsunami,
- Seiches,
- Dam, pipeline or aqueduct failure.

FIRE HAZARDS AND HAZARDOUS MATERIALS

- Earthquake induced wildland and urban fire hazards, and
- Earthquake induced hazardous materials incidences.

LIFELINE SYSTEMS

- Earthquake induced disruption to lifeline systems.

Mitigation of potential impacts on the Coachella General Plan Area, in terms of damage to lifeline systems, buildings, critical facilities, elements of land use, and the economy can be found in Section 4.0. General conclusions associated with each geologic hazard are also presented in Section 4.0.

3.1 Geologic Hazards

Introduction. A comparison of average annual losses from geologic, flood, and earthquake hazards shows that ground failures such as landslides, expansive soils, and subsidence are the primary causes of economic impact on development (Figure 35). As of 1983, annual financial losses to both public and private property in the United States were estimated to approach as much as \$1.5 billion dollars from landsliding alone (Schuster and Fleming, 1983; Schuster, 1978). Consistently rising real estate costs in southern California highlight concerns for increased economic losses from all types of ground failure, considering both annual economic impact, as well as the potential for sudden economic impact. Figure 35 shows that economic losses from landslides are second only to earthquakes.

The Coachella General Plan Area is vulnerable to a variety of geologic hazards, including soils subject to erosion, various types of landslides, expansive and collapsible soils, and subsidence. Landslide damage alone in southern California amounted to several hundred million dollars as a result of the intense rainstorms of 1978, 1980, and 1991 through 1995. The losses were attributed to landslides, debris flows, mudflows and artificial fill slope failures. Expansive soils, although related to saturation and failure of hillsides during heavy rains, are more widespread and less periodic than most landslide hazards. Damage from expansive soils generally can occur in relatively flat lying or hillside areas and can be initiated or accelerated by landscape irrigation, without any long-term rainfall. Expansive soils cause mostly moderate foundation distress but because of the widespread or localized nature of the problem, total damages and annual losses can be significant.

The expansion of development into areas underlain by loose alluvium is cause for concern for potential damage from collapsible and erodible (wind blown) soils. Numerous examples from other jurisdictions in the southwestern United States demonstrate that by inadequate consideration of collapsible soils, widespread areas of development can be adversely affected. Relatively new developments in the Murrieta area of southwestern Riverside County have suffered widely scattered settlement causing extensive damage to private property and infrastructure. Regional subsidence from groundwater withdrawal has also affected portions of Riverside County. Broad areal subsidence possibly associated with the historical withdrawal of ground water is believed responsible for subsidence and fissuring in the Temecula area. A discussion of the potential geologic hazards in the Coachella General Plan Area follows.

3.1.1 Erodability of Soil and Rock

3.1.1.1 Soil Erosion. The potential for natural erosional type hazards is most likely to be high in those Planning Areas with a combination of the following conditions: 1) moderately steep to steep slopes (>15%), 2) loose to unconsolidated soils and sediments, 3) little or no

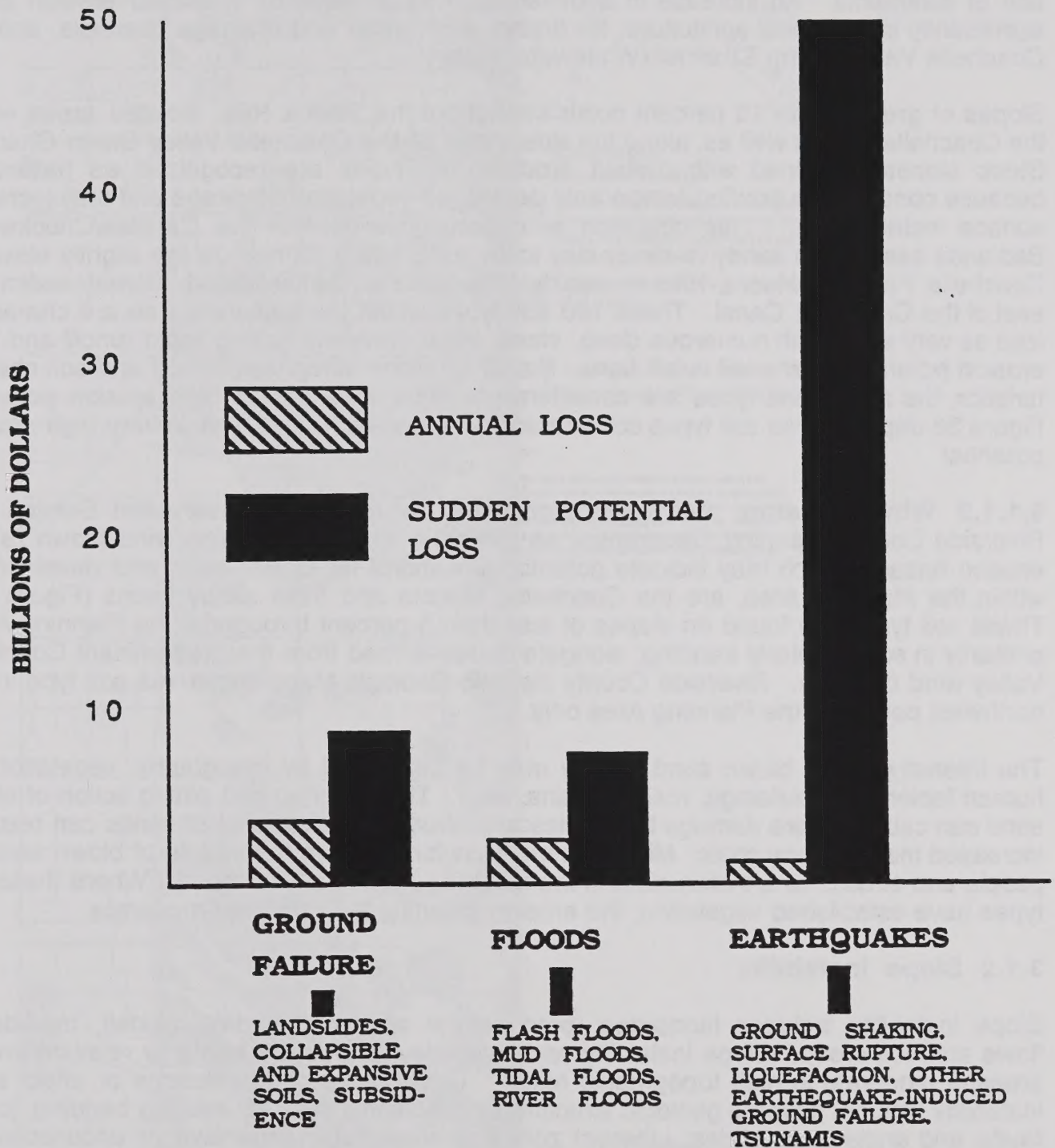


Figure 35. Estimates of average annual losses and the potential for sudden economic loss from selected hazards in the United States (after U.S. Geological Survey).

vegetation cover, and 4) uncontrolled surface water runoff. Development or earth work modifications in the Planning Area can alter the topography to create steeper slopes, remove surface vegetation and increase the amount of surface water runoff. Changes in any of the above conditions can increase erosion potential, as well as cause surface rilling. Additionally, an increase in erosion can increase downstream sediment loads with deposition of sediments. An increase in sedimentation as a result of increased erosion could significantly impact local agriculture, tile drains, stormwater and drainage channels, and the Coachella Valley Storm Channel (Whitewater River).

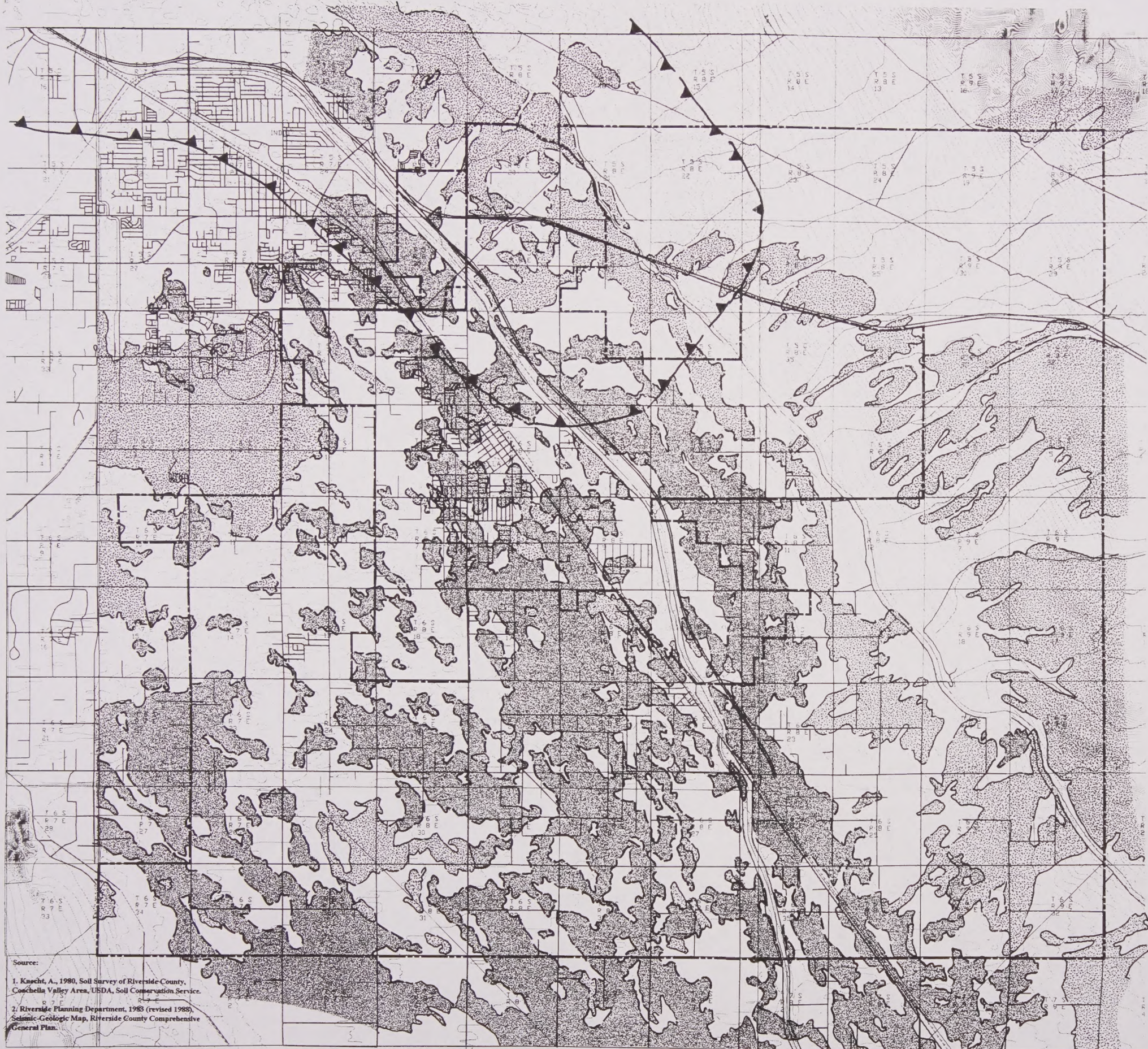
Slopes of greater than 15 percent occur throughout the Mecca Hills, isolated areas within the Coachella fan, as well as, along the sideslopes of the Coachella Valley Storm Channel. Steep slopes combined with certain erodible soil types are recognized as hazardous because construction grading temporarily decreases vegetation coverage and may increase surface water runoff. This condition is especially evident in the Carsitas/Chuckwalla-Badlands association sandy to sandy clay loam soils, which formed on the slightly elevated Coachella Fan and Mecca Hills in weakly to moderately consolidated alluvial sediments east of the Coachella Canal. These two soil types within the badlands area are characterized as very steep with numerous deep, steep sided channels having rapid runoff and high erosion potential where soil is left bare. Based on slope steepness, runoff and soil characteristics, the above soil types are considered to have very high to high erosion potential. Figure 36 depicts those soil types considered to have a high, and high to very high erosion potential.

3.1.1.2 Wind Erosion. Soil types recognized by the Soil Conservation Service and Riverside County Planning Department as having a high to very high wind blown (sand) erosion hazard, which may indicate potential limitations for construction and development within the Planning Area, are the Coachella, Myoma and Indio sandy loams (Figure 36). These soil types are found on slopes of less than 5 percent throughout the Planning Area, primarily in southeasterly trending, elongate dunes formed from the predominant Coachella Valley wind direction. Riverside County Seismic-Geologic Maps depict this soil type in the northwest portion of the Planning Area only.

The intensity of the blown sand activity may be influenced by topography, vegetation, or human factors (tall buildings, roads, basins, etc.). The scouring and pitting action of blown sand can cause severe damage to vehicles and structures. Removal of sands can result in increased maintenance costs. Mitigation methods for reducing the effects of blown sand on people and structures are discussed in the following section of this report. Where these soil types have established vegetation, the erosion potential is considered moderate.

3.1.2 Slope Instability

Slope instability includes landslides (both natural and man-made), rockfall, mud/debris flows and soil creep. Slope instability and landslide hazards are primarily relevant only to areas of moderate to high topographic relief. Other factors that influence or affect slope instability include: adverse geologic structure or conditions, such as existing bedding, joints, faults, and ancient landslides; inherent zones of weak rock; expansive or unconsolidated soils; high rainfall or groundwater (seepage, irrigation or subsurface effluent disposal), earthquakes, and changes to topography due to erosion or surface alterations (i.e. grading). A majority of these conditions occur in the Mecca Hills, Coachella fan or along the Coachella Valley Stormwater Channel, in the eastern part of the General Plan Area.



CITY OF COACHELLA GENERAL PLAN

Explanation

Erosion Potential

- High to Very High; includes Coachella and Myoma Soil Series (primarily blow sand), and Badlands areas east of the Coachella Canal (water erosion).
- High; includes Indio Soil Series (primarily wind erosion).

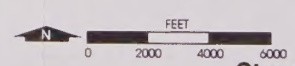
Active Blow Sand Area Boundary
(Riverside County Planning Department)

Notes:

1. The wind and water erosion potential depicted on this map is based on information obtained from the Soil Conservation Service for the Planning Area. Some soils series have been grouped together based on common characteristics. In this regard, the use of this figure should be limited to general land-use planning purposes, only.

Source:
1. Knecht, A., 1980, Soil Survey of Riverside County, Coachella Valley Area, USDA, Soil Conservation Service.
2. Riverside Planning Department, 1983 (revised 1985), Seismic-Geologic Map, Riverside County Comprehensive General Plan.

Coachella General Plan Area
Figure 36
Generalized Erosion Potential



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Generally, landslides are sometimes more easily understood when we refer to the "downward and outward movement of slope-forming materials composed of natural rock, soils, artificial fills, or combinations of these materials. The moving mass may proceed by any of three types of movement: 1) Falling; 2) Sliding; and, 3) Flowing (Varnes, 1958)." Actual landslide deposits or potential landslide areas will consist of a mass of material that has moved downslope or is capable of moving downslope. Based on the available literature, no landslides of sufficient detail and size, greater than five acres, have been mapped in the General Plan Area. In this regard, the Generalized Landslide Potential Map (Figure 37) prepared for this study depicts areas that are capable of having landslides given the conditions reflected above. This figure should be used for general planning purposes only, and is not intended to preclude the need for site-specific study.

In detail, there are many types of potential landslides that may occur in primarily hillside areas. In order to understand the discussions about the types of potential landslide hazards in the Coachella Planning Area, it is important to gain some understanding of the types of slope failures that are generally considered. To aid in that process, some illustrative figures of some of the basic landslide types are depicted on Figures 38 and 39. These examples correspond to Falls, Slides, Slumps, Flows, Complex Slides, and Creep. Although these Figures represent typical landslides, it is anticipated that a majority of the potential landslides that could occur in the General Plan Area include soil slumps and rock falls caused by earthquake activity, debris flow/mud flows caused by rainfall or concentrated runoff, or man and development induced landslides. A description of these landslide types follow.

3.1.2.1 Landslides Caused by Earthquake Ground Shaking. A study of 300 earthquakes that occurred in the United States between 1958 and 1977 was made by David K. Keefer (1984) of the U.S. Geological Survey. He determined the following correlation between various Richter magnitudes (M) and the type of slope failures:

- | | | |
|-----|--------------|--|
| (1) | $M \geq 4.0$ | rock falls, rock slides (and earthblock falls), soil falls, and disrupted soil slides. |
| (2) | $M \geq 4.5$ | soil slumps and soil block glides. |
| (3) | $M \geq 5.0$ | rock slumps, rock block slides, slow earth flows, soil lateral spreads, rapid soil flows, and subaqueous landslides. |
| (4) | $M \geq 6.0$ | rock avalanches. |
| (5) | $M \geq 6.5$ | soil avalanches. |

Magnitude 4.0 and greater earthquakes are anticipated within the General Plan Area (see seismic section). In this regard, the most likely type of sliding that could adversely affect the Coachella General Plan Area would be earth block falls occurring in the Mecca Hills or soil slumps occurring along slope banks within the Coachella Valley Storm Channel. The block fall type occurrence was found to occur in virtually all types of geologic rock units on slopes steeper than 40 degrees.

Earthquake shaking ($M \geq 6.5$) could also trigger slumps in old, poorly compacted artificial fill. Highly susceptible fills are those related to housing developments, railroad embankments, the outer edges of highway embankments, dikes and bridge abutments (EERI, 1986). Bridge and highway approaches settled due to slope failure, displacing the roadway as much as 2 to 3 feet during the 1971 San Fernando Earthquake in Los Angeles (Oakshott, 1971). Additionally, the 1979 Imperial Valley earthquake impacted bridges, and improvement related to the I-8 freeway.

The first part of the report describes the background and objectives of the study. It also provides a brief overview of the methodology used in the study. The second part of the report presents the results of the study. This includes a description of the data collected and the analysis performed. The third part of the report discusses the implications of the findings and provides recommendations for future research.

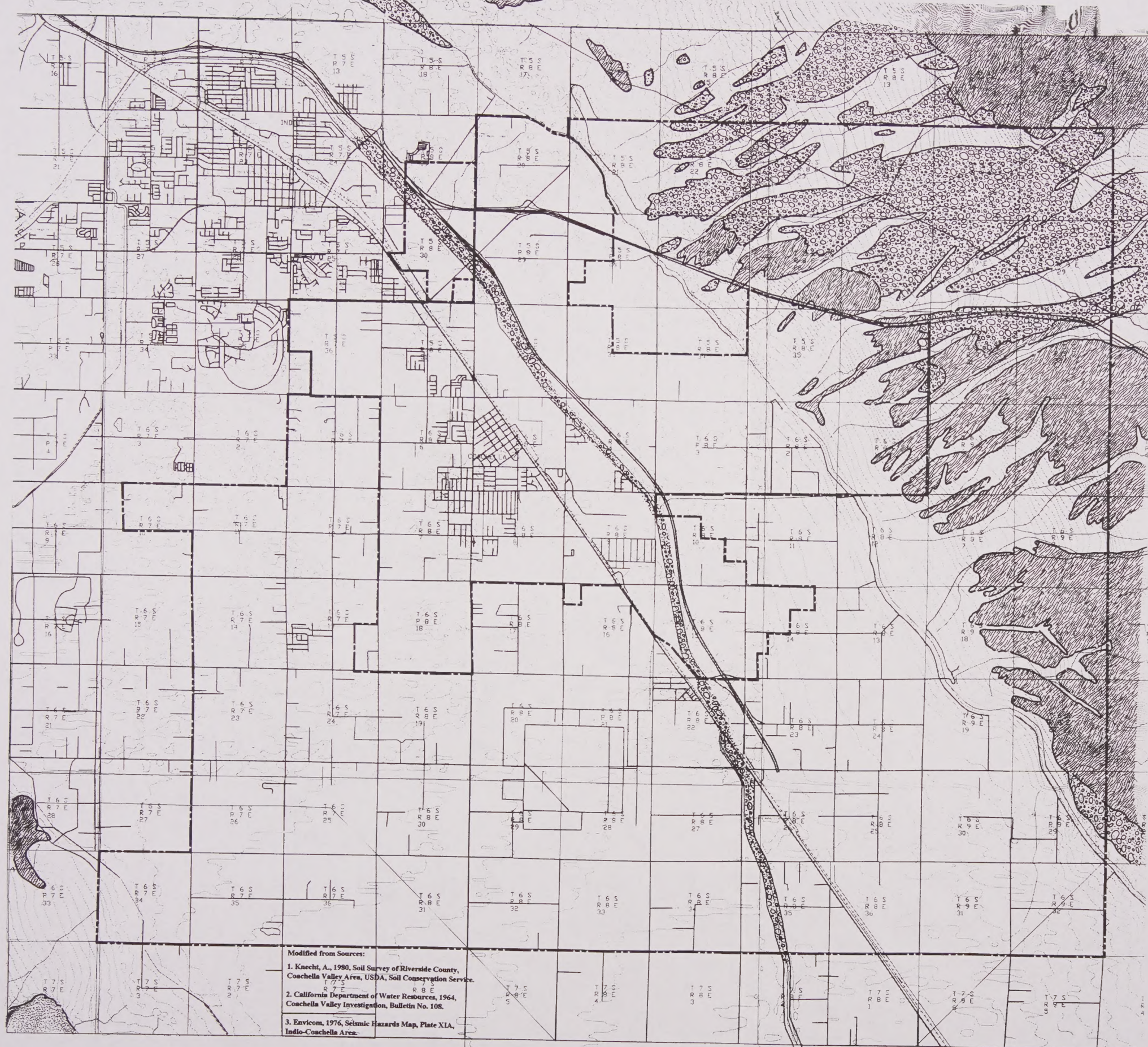
The study was conducted in a laboratory setting. The participants were recruited from a local university. The study was approved by the Institutional Review Board. The data was collected over a period of six months. The results of the study are presented in the following sections.

The first section of the results presents the demographic characteristics of the participants. The second section presents the results of the pre-test. The third section presents the results of the main study.

1	10-15	10-15	10-15
2	16-20	16-20	16-20
3	21-25	21-25	21-25
4	26-30	26-30	26-30
5	31-35	31-35	31-35
6	36-40	36-40	36-40
7	41-45	41-45	41-45
8	46-50	46-50	46-50
9	51-55	51-55	51-55
10	56-60	56-60	56-60

The results of the study are presented in the following sections. The first section presents the results of the pre-test. The second section presents the results of the main study. The third section presents the results of the post-test.

The study was conducted in a laboratory setting. The participants were recruited from a local university. The study was approved by the Institutional Review Board. The data was collected over a period of six months. The results of the study are presented in the following sections.



CITY OF COACHELLA GENERAL PLAN

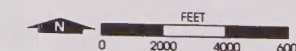
- Explanation**
- Generalized Landslide Potential**
-  Low to Moderate
 -  Moderate to High
 -  Mapped, Existing Landslide

- Notes:**
1. In general, landslide potential is based on soil type, rock type and slope gradient. Most landslides in the Planning Area will occur in the form of stream channel bank failures and debris flows; primarily easterly of the Coachella Canal.
 2. Hillside areas with few or no existing landslides or landslide potential may reflect the status of landslide mapping or the presence of landslides less than five acres. This map does not preclude the existence of existing landslides or the potential for slope failures outside of landslide prone areas as compiled.
 3. Use of this map should be limited to general land-use planning purposes.

Modified from Sources:

1. Knecht, A., 1980, Soil Survey of Riverside County, Coachella Valley Area, USDA, Soil Conservation Service.
2. California Department of Water Resources, 1964, Coachella Valley Investigation, Bulletin No. 108.
3. Envicom, 1976, Seismic Hazards Map, Plate XIA, Indio-Coachella Area.

Coachella General Plan Area
Figure 37
Landslide Potential

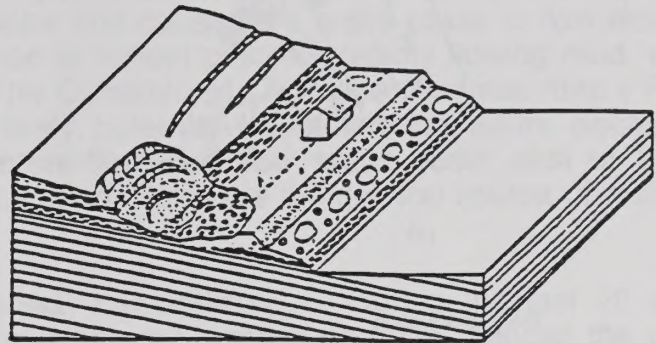


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LANDSLIDE HAZARDS



Development-Induced



Earthquake-Induced
(modified after EERI, 1986)



Rain-Induced Debris Flow
(Source: USGS)

Figure 38. Different types of landslide hazards capable of threatening public safety and property.

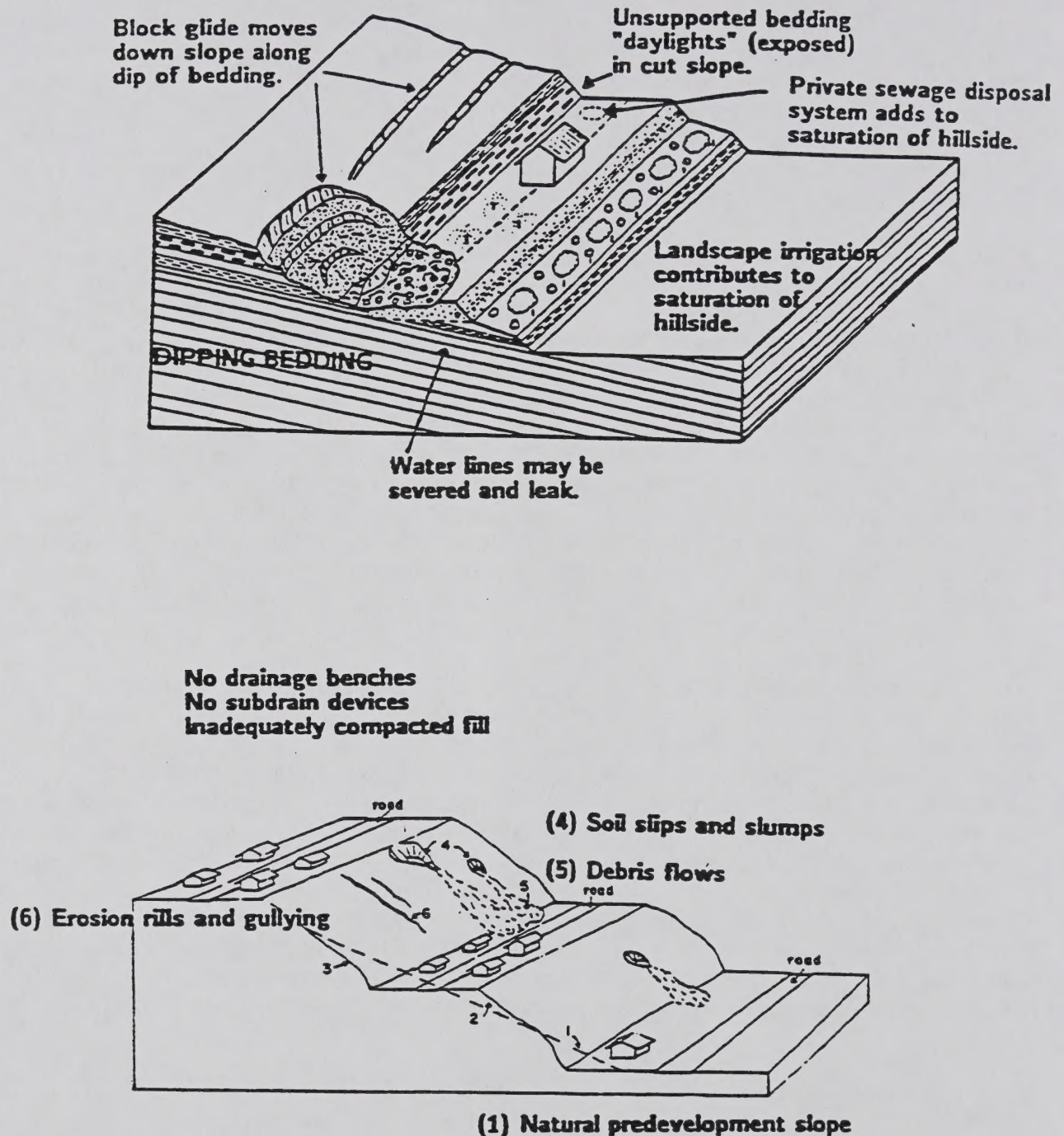


Figure 40. Slope instability caused by improper hillside development. Out of slope bedding is made unstable through the overwatering of slopes and leaky sewage systems (above). Improper grading practices or inadequate design for out-of-slope bedding, or poorly-indurated (loose) sandy bedrock in the slope face, can lead to erosion, slumps, and landsliding, especially when the slope is oversteepened (below). Modified after Leighton, 1966; and Weber, et. al., 1982.

Yucaipa and San Jacinto Valleys in California, and the Phoenix and Tucson Basins in Arizona. Despite efforts to recharge aquifers, subsidence often occurs during years of heavy groundwater withdrawal.

In general, effects of subsidence from groundwater withdrawal range from cracks or fissures which form on the surface to visible settling relative to adjacent areas. While subsidence has not yet been documented to any significant extent in the Coachella General Plan Area (Robbins, 1995), it appears highly likely that it has occurred due to overdrafting of the Thermal Subarea lower groundwater aquifer as depicted in Section 2.3.2.1. Additionally, the current groundwater withdrawal practices and geologic conditions within the Coachella Valley are similar to other areas of Riverside County experiencing subsidence problems. Based on groundwater withdrawal in the Thermal Subarea lower aquifer, the potential for subsidence due to groundwater withdrawal should be considered as moderate to high in that portion of the Planning Area that occurs west of the All American Canal.

Subsidence can also be related to seismic activity. Such impacts are described in the Section on Seismicity 3.2.5, Secondary Effects of Seismic Hazards.

3.1.4 Collapsible Soils

Collapsible soils are low density, silty to very fine-grained, predominately granular soils, containing very small pore spaces and voids. When saturated, these soils undergo a rearrangement of their grains and a loss of cementation, resulting in substantial and rapid settlement under relatively low loads. A rise in the ground water table or an increase in surface water infiltration, combined with the weight of a building or structure, can initiate rapid settlement and cause the foundations and walls of these facilities to crack. Collapsible soils generally result from rapid deposition close to the source of the sediment where the materials have not had contact with enough moisture to form a compact soil after their deposition.

Collapsible soils are associated with recently deposited surficial Holocene alluvium within valleys and stream bottoms, and at the base of slopes rimming the valley. Most collapsible soils are associated with arid and semi-arid environments, such as found in the Coachella General Plan Area. They can also coincide with other Holocene alluvium and older unconsolidated sediments with the above same properties, such as those sediments occurring in the Coachella fan area. Collapsible soils are most commonly associated with eolian (wind) deposited sands and silts, and mudflow sediment deposited at the base of slopes during flash floods. Collapsible soils may fail with a minimal amount of increased overburden. Those alluvial soils found in the central Planning area, as well as soils rimming the valley should be considered to have a moderate to high potential for collapse.

3.1.5 Expansive Soils Hazards

Among the various geologic hazards that affect the State of California, expansive soils have caused millions of dollars in damages, particularly to single family residences and private property improvements. The State Department of Natural Resources estimates that by the year 2000, expansive soils will have been a \$150 million problem in the state (LA County, 1990).

Expansive soils are those possessing clay particles, sometimes different kinds of clays (bentonite, montmorillonite, and others) that react to moisture changes by shrinking (when they dry) or swelling (when they get wet). Expansive soils can also consist of silty to sandy clay and clayey sand. Extent of shrinking and swelling is influenced by environment, such as alternating wet and dry cycles, and by the amount and kind of clay in the soil. This type of physical change in the soils can react unfavorably with building foundations, concrete slabs-on-grade, concrete walkways, patios, swimming pools, roadways, and masonry walls.

Other concerns that can be associated with expansive soils are:

1. Ruptured utility lines.
2. Changing elevations of sidewalks, paved areas, and streets, particularly where water is impounded or diverted.
3. The weathering and slumping of slopes.
4. The breaking up of drainage devices, particularly concrete and asphalt linings.

In hillside areas these situations may become critical. The heaving and subsequent shrinkage cracks allow more rapid weathering and saturation of the slopes, causing downslope creep and surficial slumping. This progression of slope failure is due to such things as:

- Reduction in the soil density (compaction),
- Degradation and reduction in the physical strength of the soil to resist downslope movement, and
- Opening of cracks to admit water and create pore pressures which seriously jeopardize slope stability.

Coachella General Plan Areas subject to potential expansive soil hazards are depicted on the Generalized Expansion Potential Map, Figure 41. According to the Soil Conservation Service, the Imperial and Salton soil series are considered to have a low to high expansion potential. These soils generally occur in the southern portion of the General Plan Area. Soils derived from weathering of consolidated sedimentary rocks in the Mecca Hills in and around the San Andreas fault zone are also considered to have a moderate expansion potential. However, due to the sporadic nature of clayey sedimentary bedrock and fault gouge, the Mecca Hills area could not be assigned an expansive soil classification.

3.1.6 Percolation Potential/Effluent Disposal

Those hillside sections of the Planning Area where on-site sewage effluent disposal is necessary for development may create impacts to down stream water quality and initiate or contribute to slope instability. Most soil types within the gently sloped or flatter portions of the Planning Area are of sufficient thickness to preclude effluent from being introduced directly into fractured rock or to daylight to the ground surface. Subsurface water added to already shallow groundwater levels through on-site sewage disposal systems could increase concerns with the secondary effects of seismic hazards, such as liquefaction discussed in following sections. Mecca Hills (badlands) soils are considered to have a moderate to high impact to slope instability and groundwater quality from effluent disposal.

3.2 Faulting and Seismic Hazards

Introduction. As indicated previously, the Coachella General Plan Area is situated within the highly seismically-active southern California region. Based on its tectonic setting, southern California is located on the boundary of two lithospheric plates: the Pacific plate and the North American plate. Movement along these two plate boundaries causes earthquakes or "seismicity" primarily when the northwest motion of the Pacific plate slides past the North American plate in what is termed right-lateral transform "strike-slip" motion. The surface expression or boundary between these two plates is evident by the northwest trending system of faults known as the San Andreas fault system. The Coachella Valley segment of the San Andreas fault within the eastern portion of the Plan Area is part of this system.

Setting. Fault activity is evident in the northeasterly portion of the Planning Area. Besides the Coachella Valley segment of the San Andreas fault, other faults including the Skeleton Canyon, Painted Canyon, Indio Hills and the Coachella Fan fault zone are located in the easterly portion of the Plan Area. Most of these faults, or fault zones or complexes, appear to be products of sympathetic movement from rupture associated with motion transfer along the San Andreas fault zone. A much older detachment fault system, known as the Santa Rosa Mountain detachment fault, also occurs in a moderately eastward dipping plane beneath the valley portion of the Planning Area. The Coachella Valley segment of the San Andreas fault truncates or "cuts off" this detachment fault at depth. With the exception of the Santa Rosa Mountain detachment fault, the approximate location of all of the above faults are depicted on Figure 42.

Surface rupture is one of the primary effects of an earthquake where displacement occurs along the fault zone and may produce ground surface uplift or subsidence. The Alquist Priolo Earthquake Fault Zone Act, formerly called the Alquist-Priolo Special Studies Zone Act, was enacted in 1972 to mitigate the hazard of surface fault rupture along active faults in California (Topozada and others, 1993). The California Division of Mines and Geology uses surface displacement within the past 11,000 years (Holocene time) to determine the surface rupture hazard during an earthquake at potentially active fault zones. Additionally, the County of Riverside has established County Fault Zones to evaluate active and potentially active faults not yet placed within APEFZ's. The extent of damage due to surface rupture is thought to occur along active portions of fault zones. However, the effectiveness of determining this earthquake impact varies depending upon the site geology and fault motion. At times, surface rupture does not accompany seismic activity or earthquakes. During the Northridge earthquake on January 17, 1994, which occurred on a blind thrust or detachment type fault, no surface rupture occurred (ENR, Jan. 31, 1994). The principal seismic hazards resulting from the Northridge earthquake was strong ground motion, liquefaction and landslides, which could also be expected for the Coachella area in the event of nearby or distant moderate to large earthquakes.

In order to effectively implement mitigation measures prior to development, it is critical to define the precise location of all "active faults" to establish structure setbacks from the fault trace. This normally requires subsurface geologic and geotechnical studies, especially where fault and fault related features are concealed from view. The Alquist-Priolo Earthquake Fault Zone Act (APEFZA) and County of Riverside Fault Hazard Zones have provided a State or County-mandated mechanism, respectively, for mitigating the fault rupture hazard in the vicinity of the inferred trace of some of these faults. The APEFZ Act and

established County Fault Zones provides local governments with the means and preliminary fault maps needed to identify zones of potential fault rupture hazards. Presently, there remains sufficient uncertainty to warrant conservatism in our mitigation policies with respect to faulting. A discussion of the above faults and associated activity or history, as it pertains to the Planning Area, will be described in following subsection.

3.2.1 Fault Rupture Hazards

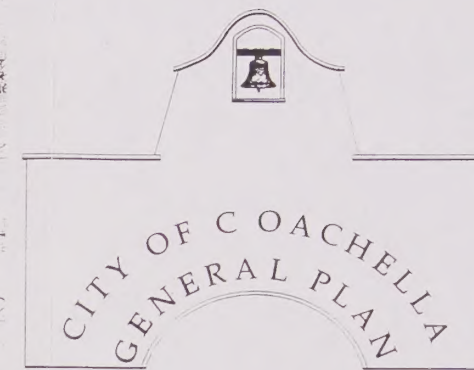
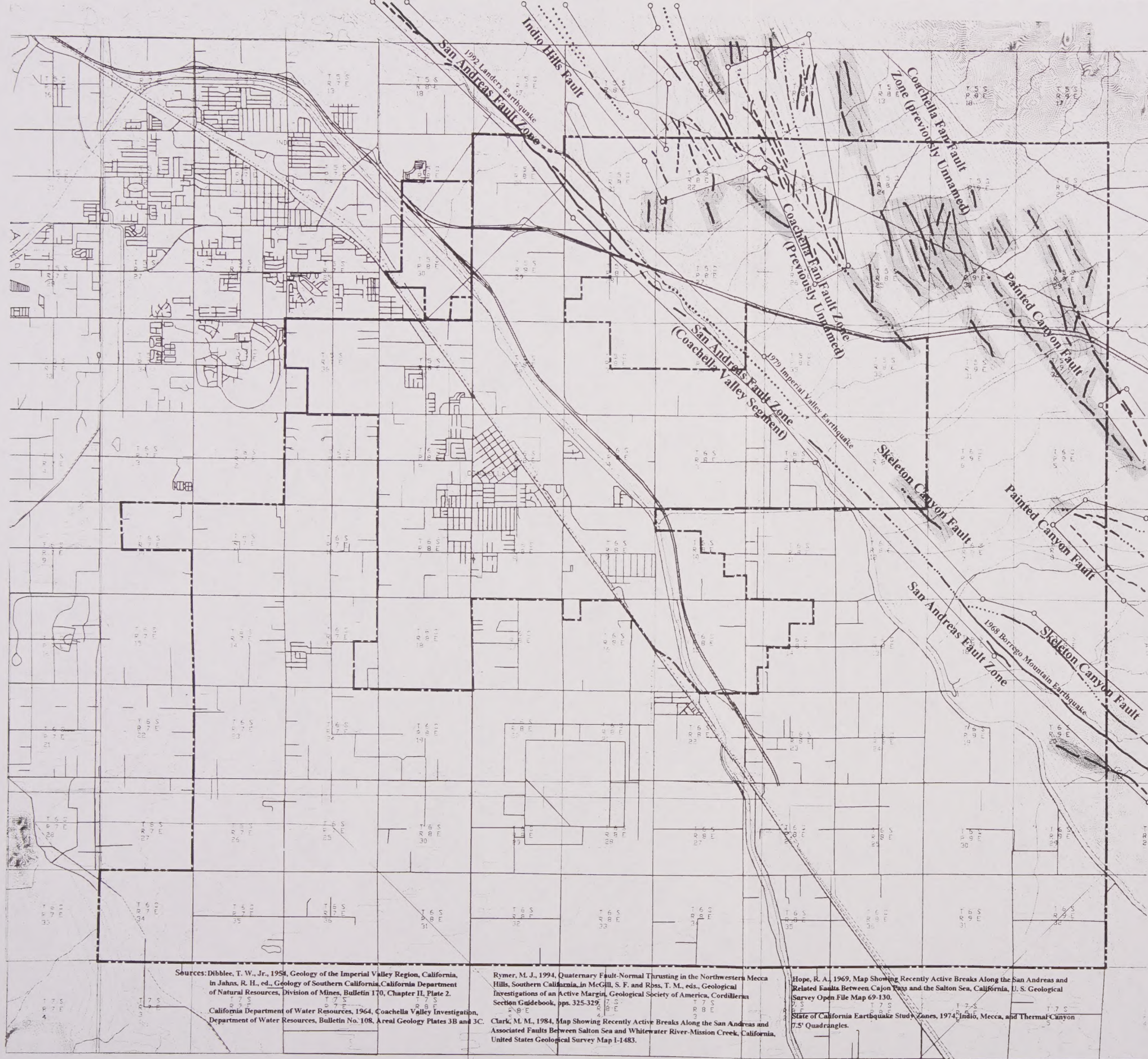
As discussed in Section 2 of this Seismic and Geologic Technical Appendix, the Coachella General Plan Area lies in a tectonically active part of southern California and is crossed by the Coachella Valley Segment of the San Andreas Fault. This fault segment may have ruptured in a large earthquake as recently as 1680. Paleoseismological studies suggest that the average recurrence interval of a large event on the Coachella Valley segment of the San Andreas Fault is 220 years (Working Group, 1995). In this regard, fault rupture associated with seismic activity may be overdue. Such an event would likely rupture the ground surface along the trace of the fault and in addition cause ground ruptures along numerous sympathetic or antithetic faults that are present in the Coachella Fan fault zone or Indio and Mecca Hills areas.

The Fault Hazards Map (Figure 42) depicts the location of the active trace of the Coachella Valley segment of the San Andreas Fault within the Coachella General Plan Area along with other faults east of the San Andreas that are also considered active by APEFZA criteria, or at a minimum, potentially active. Faults that have been classified as potentially active have generally been poorly or inadequately studied, but which appear to have had surface rupture activity in the last 750,000 years. Faults showing no evidence of movement or surface rupture within the last 750,000 years are considered conditionally active or "inactive" for most purposes. The designation of faults as either active or inactive is largely dependent on the classification system used, and the relative importance of the structure under consideration. An "active" fault considered in siting and designing facilities such as hospitals and other critical facilities, may not be considered active in building conventional residential or commercial developments (Figure 43).

3.2.1.1 Fault Classification. The following guidelines for interpreting and classifying the "activity" of the faults (as modified from LA County, 1990) are shown on the Fault Rupture Hazards Map (Figure 41). This Map was constructed to assist in the planning of future development in the Coachella General Plan Area. Because the scale of the map only allows resolution to a maximum of 1000 feet, the map should not be used in lieu of site specific investigations. The primary goal of the map is to aid in the reduction of potential property damage and increase the safety of the public by identifying fault rupture hazards in the Plan Area not currently recognized by the State mandated Alquist-Priolo Act or specific County of Riverside Fault Zones. It should be noted that fault rupture may occur outside of the fault areas indicated on Figure 41.

Active:

- 1) The fault is within an APEFZ or Riverside County Fault Hazard Zone (RCFHZ).
- 2) The fault is suspected or proven to displace Holocene age (10,000 years or younger) alluvium, as noted in the literature or reported in available unpublished geotechnical reports.
- 3) A fault segment lies interposed between two APEFZ or RCFHZ faults, adjoins and appears to extend an APEFZ or RCFHZ fault, or a mechanically distinct segment (fault segment) includes a APEFZ or RCFHZ fault.



Fault Explanation

Fault Management Symbols

- Active-APEFZ
0-11,000 years BP (Before Present) Evidence of historic offset indicated by year of earthquake-associated event.
- Active/Potentially Active
0-750,000 years BP

Fault Map Symbols

- Fault, approx. located.
- Fault, approx. located-concealed.

Notes:

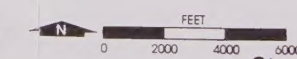
1. The main objective of this map is to delineate fault hazards recognized by the CDMG-mandated Alquist-Prilo Earthquake Fault Zone Act (APEFZA). Additional faults inferred to be active or potentially active are included on this map because there is published information or scientific opinion by staffs of authoritative agencies that indicate that there is a reason to consider them active. Their inclusion is not intended to prohibit development, but to ensure that proposed projects are supported by geological/seismic investigations that will provide the most accurate obtainable data on the presence or absence of a hazard, and identify necessary mitigation measures.
2. The fault locations on this map are based on published information. Detailed geological investigations, including trenching studies, make it possible to refine the location and activity status of faults. The use of this figure should be limited to general land-use planning purposes only, and should be amended as new data becomes available and are validated.
3. The width of the fault shading does not define a special study limit. Fault shading is used solely to differentiate active faults and non-APEFZ faults from non-active faults. The width of the shaded zone and fault locations should not be used in lieu of site-specific investigations, evaluations and design.

Sources: Dibble, T. W., Jr., 1954, Geology of the Imperial Valley Region, California, in Jahns, R. H., ed., Geology of Southern California, California Department of Natural Resources, Division of Mines, Bulletin 170, Chapter II, Plate 2.
California Department of Water Resources, 1964, Coachella Valley Investigation, Department of Water Resources, Bulletin No. 108, Areal Geology Plates 3B and 3C.

Rymer, M. J., 1994, Quaternary Fault-Normal Thrusting in the Northwestern Mecca Hills, Southern California, in McGill, S. F. and Rbas, T. M., eds., Geological Investigations of an Active Margin, Geological Society of America, Cordilleran Section Guidebook, pps. 325-329.
Clark, M. M., 1984, Map Showing Recently Active Breaks Along the San Andreas and Associated Faults Between Salton Sea and Whitewater River-Mission Creek, California, United States Geological Survey Map 1-1483.

Hope, R. A., 1969, Map Showing Recently Active Breaks Along the San Andreas and Related Faults Between Cajon Pass and the Salton Sea, California, U. S. Geological Survey Open File Map 69-130.
State of California Earthquake Study Zones, 1974, Indio, Mecca, and Thermal Canyon 7.5' Quadrangles.

Coachella General Plan Area
Figure 42
Fault Rupture Hazards



Steven C. Suitt and Associates
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Hydrogeologists and Earth Science Professionals

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EARTHQUAKE RECURRENCE AND FAULT ACTIVITY

POSSIBLE RISK CRITERIA: LAND USES

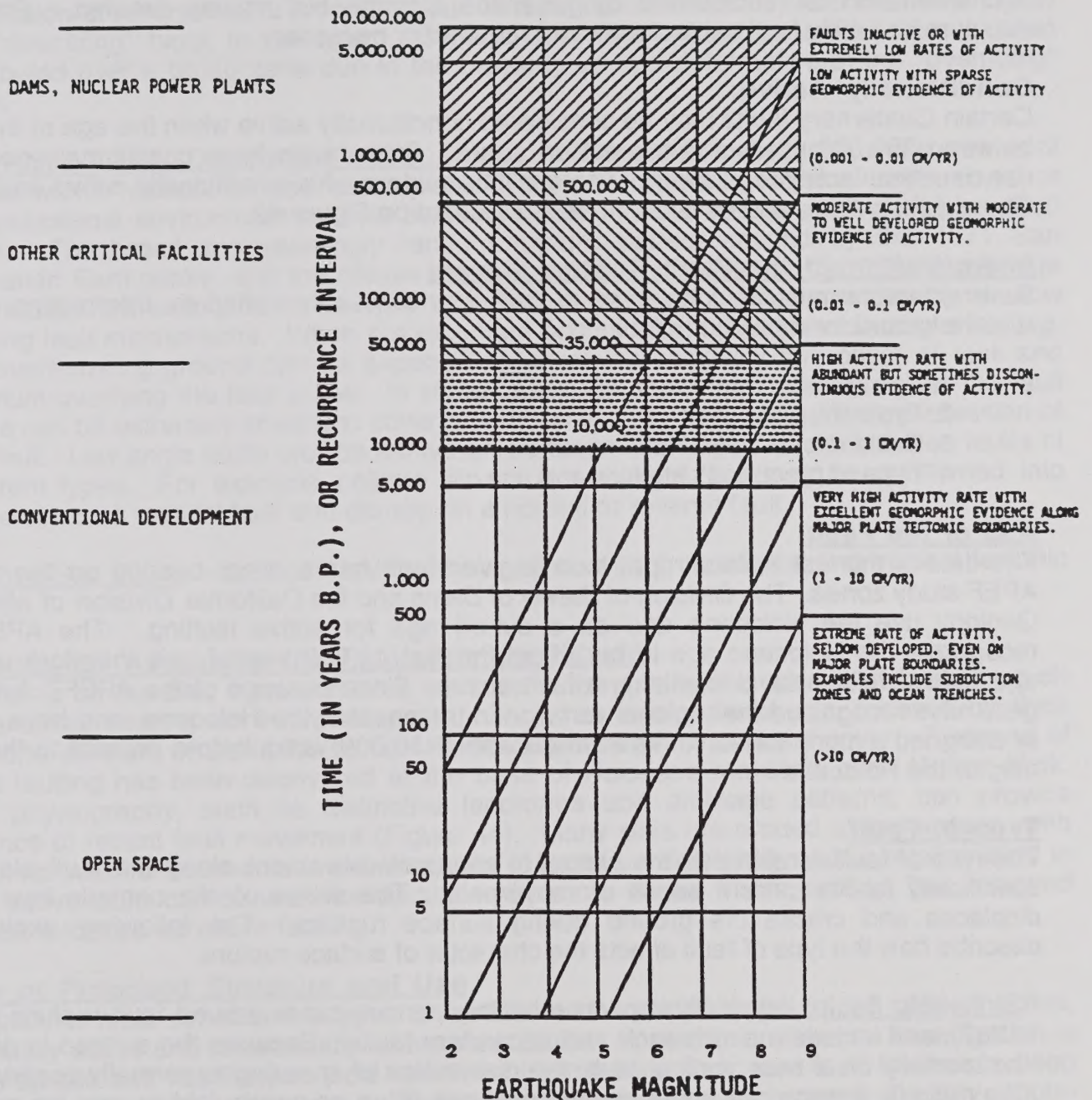


Figure 43. Earthquake recurrence and fault activity; earthquake magnitude, fault slip rate, and recurrence (return period) of earthquakes are used to infer relative activity. The graph does not directly reveal the potential for surface rupture. Modified from Slemmons, 1977; LA County, 1990).

- 4) An adjacent potentially active fault parallels an active fault, the fault overlaps or intersects an existing or proposed "Fault Zone" study area, and the fault displays the same tectonic character (i.e., geometry, slip mechanism, etc.).
- 5) The fault is not well studied, but is covered by one of the above criteria.

Potentially Active:

Proven or probable Late Quaternary (last 750,000 years) movement is cited in the literature or unpublished reports (LA County, 1990). Potentially active faults require special studies and evaluation as established by Riverside County, but not as detailed. Oftentimes, structure or facility fault setbacks are not required or necessary.

Conditionally Active:

Certain Quaternary faults may be considered conditionally active when the age of the fault is between 750,000 years and two million years. Such faults have conditional special land use or critical facility regulations. There is little evidence for conditionally active faults in the General Plan Area, and as such, none are located on Figure 42.

Interpretation of the Fault Rupture Hazard

Several factors must be considered in, but not necessarily limited to, interpreting the fault rupture hazard for a particular fault:

1. Age of fault,
2. Type of fault,
3. Evidence for age of faulting, and
4. Type of proposed structure and use.

Age of the Fault

The date of the last surface rupture on a given fault has a direct bearing on the need for APEF study zones. The Division of Safety of Dams and the California Division of Mines and Geology use the Holocene age as a cut-off age for active faulting. The APEFZ Act recognizes the Holocene age to be "about the last 11,000 years," and therefore uses this age as a condition for designating a fault active. Since passage of the APEFZ Act, geologists have recognized the regional variation in the onset of the Holocene, and have arbitrarily assigned a more conservative average age of 10,000 years before present to the beginning of the Holocene.

Type of Fault

The type of fault is related to the history of apparent movement along the fault plane, and specifically to the current sense of movement. The sense of slip controls how a fault displaces and cracks the ground during surface rupture. The following explanations describe how the type of fault affects the character of surface rupture.

- **Strike-Slip Faults** -- typically impacts relatively narrow zones around fault rupture (Bonilla, 1967), and include main, branch and secondary faults. Because the surface is displaced horizontally on a near vertical fault, the distribution of shearing is normally confined near the main fault trace. In some cases, localized tilting or gentle folding can be expected. Secondary faults are common as are branching splays from the main fault.

- **Normal Faults** -- are commonly formed in an extensional tectonic environment, manifested as the down-dropping of one block relative to another. The surface expression of a normal fault is variable due to topographic influences, and due to complexities in the fault surface itself. Surface deformation from an earthquake may extend over a broad zone due to tilting and block deformation.
- **Reverse Faults** -- are commonly formed in a contractional or convergent tectonic environments manifested as the uplifting of one block up and over another block. The surface expression of reverse faults is complex due to topographic influences and the tendency for the "overriding" block to fall apart. Surface deformation from an earthquake is often distributed over a broad zone due to the breaking up and deformation of the "overriding" block.
- **Low Angle Faults (Detachment and/or Thrust)** -- characteristically have wider zones of impact with or without surface fault rupture. They are formed in either an extensional or compressional environment as one block overrides another on a shallow dipping fault plane. The broad and seemingly random rupture pattern caused by the 1971 San Fernando Earthquake, and the diffuse array of seismicity related to the 1994 Northridge Earthquake are examples of the type of pattern capable of being generated by shallow dipping fault mechanisms. When displacement occurs with thrust type low angle faulting, the overthrusting ground can be expected to shear the relatively thin cover of rock and alluvium overlying the fault plane. In some cases the depth from the surface to the fault plane can be extremely small and cover a wide area away from the surface expression of the fault. Low angle faults provide a mechanism for partitioning of strain between faults of different types. For example, oblique slip on a low angle fault may be partitioned into strike-slip on a vertical fault and dip-slip on a normal or reverse fault.
- **Oblique-Slip Faults** -- are commonly a combination of both horizontal and vertical tectonic motion.

Evidence for Assessing the Fault Rupture Hazard

Depending on the site, there can be a variance in the quality of evidence of faulting which has a direct bearing on interpreting risk. In some areas, faults are covered by thick Holocene alluvium or disrupted by landslides, debris flows, or colluvial cover. Evidence of active faulting has been discovered at the base of Holocene materials over 18 feet thick. Fault physiography, such as distinctive landforms and drainage patterns, can provide evidence of recent fault movement (Figure 44). Many sites are eroded at the surface, with little or no youthful sediments to show recency of faulting. Seismicity and/or relationships to other active faults can be used for evaluation in some cases where erosion has removed surficial evidence for active faulting.

Type of Proposed Structure and Use

The planner must consider the types of facilities and acceptable risk in the case of active, potentially active and conditionally active older faults. In addition, where an investigation is inappropriate and not likely to yield additional information, such as a fault located in deep alluvial fill, acceptable risk cannot be accurately determined. In such cases, the City regulations supported by Riverside County guidelines can be conservative, but the extent and scope of the regulations depends on the level of risk the City is willing to accept, given the uncertainty. Fault zone regulations should remain flexible as the activity of the fault becomes better known. Sometimes, unfortunately, fault activity only becomes known during a large earthquake occurrence.

FAULT PHYSIOGRAPHY

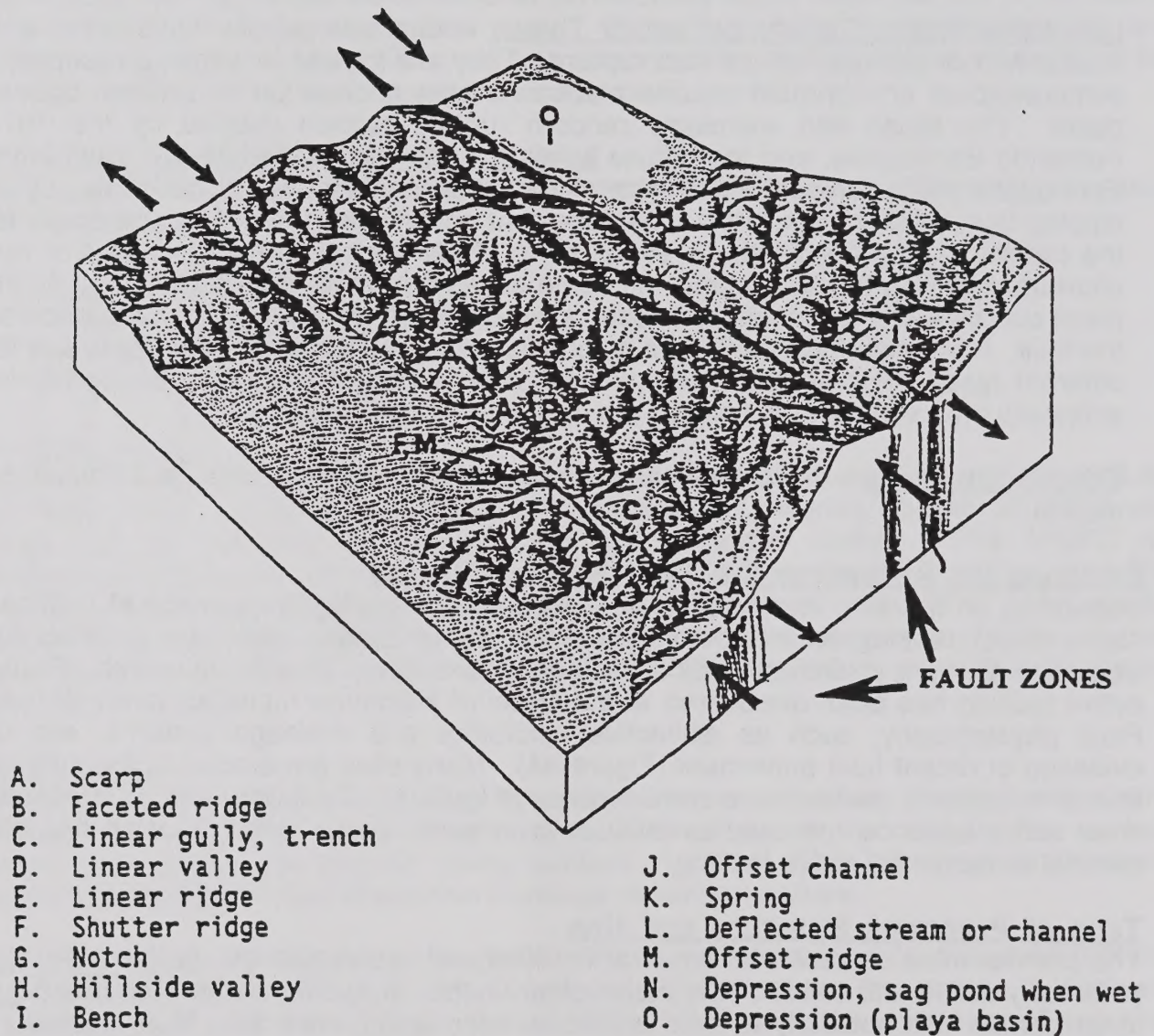


Figure 44. Fault physiography: distinctive landforms and drainage patterns aligned along strike-slip faults are visible evidence that fault movement is recent enough to have interrupted the more gradual processes of erosion. Modified after Brown and Kockelman, 1983; USGS Map I-741.

3.2.1.2 Faults Within the Coachella General Plan Area. Several active and potentially active faults either transect or are in close proximity to the northeastern portion of the General Plan Area. An inactive older detachment fault also underlies the Coachella General Plan Area west of the San Andreas fault. A general description of these faults or fault zones is discussed below.

The Coachella Valley Segment of the San Andreas Fault. The principal active fault in the Coachella General Plan Area is the Coachella Valley segment of the San Andreas fault (Figure 42). The Coachella Valley segment comprises the southern 100 km of the San Andreas fault, extending from San Geronimo Pass on the northwest to the Salton Sea on the southeast. The last large earthquake with its epicenter on the Coachella Valley segment of the San Andreas Fault occurred about 300 years ago, in 1680. Recent data suggests, however, that earthquake events in Indio in 1680 and 1450 may have ruptured simultaneously in the Coachella Valley and the San Bernardino Mountains segment of the San Andreas fault. The 1857 Fort Tejon earthquake (M7.9) broke a large segment of the San Andreas fault from Cajon Pass to Cholame (Sieh, 1986). Data from paleoseismological studies suggests that the average recurrence interval of a large magnitude earthquake on the Coachella Valley segment of the San Andreas fault is 220 years (Working Group, 1995).

The most recent faulting in the Coachella area has been associated with "right lateral strike slip" movement on vertical or high angle faults associated with the San Andreas system of faults. In the Coachella area, the San Andreas fault has an average slip rate of about 25 mm/yr. Based on its past earthquake history, the Coachella Valley segment of the San Andreas fault has a $22 \pm 12\%$ (high) probability of suffering a large earthquake of $M \geq 7$ during the next three decades (Working Group, 1995).

Skeleton Canyon, Painted Canyon, Indio Hills, and the Coachella Fan Fault Zone. To the east of the Coachella Valley segment of the San Andreas fault zone, and within the Coachella General Plan Area, are several northwest trending fault branches associated with or related to sympathetic movement within the San Andreas fault zone. These faults include the Skeleton Canyon, Painted Canyon, Indio Hills, and Coachella Fan fault zone (Figure 42). The Coachella Fan fault zone was previously unnamed, but mapped by Clark (1984) and is visible on aerial photographs (1974) of the area. Portions of the Coachella Fan Fault zone are included in the Alquist Priolo Earthquake Fault Study Zone for Indio, Mecca, and Thermal Canyon 7.5' Minute Series (Topographic) Quadrangles. The remaining fault areas evident in the literature, but not yet classified within the Earthquake Fault Study Zone or Riverside County Fault Hazard Zone boundaries should be classified as active or as a minimum as potentially active. The Skeleton Canyon fault zone consists of two branches as mapped by Rymer (1994). The southern segment has been included in the APEFSZ. The northern portion is considered active/potentially active as it displaced or off-sets the late Quaternary Bishop Ash beds as mapped by Rymer (1991). Additionally, there are numerous northerly extensions of the Painted Canyon fault zone and south trending extensions of the Indio fault zone. These fault zone extensions should also be considered active, or at a minimum potentially active, unless site specific geologic investigations demonstrate otherwise.

Santa Rosa Mountains Detachment Fault. In the southern California area, earthquake epicenters are more widely dispersed than in other parts of California. The diffuse pattern of activity may be related to low-angle buried faults that may not be directly known or mapped. In the Los Angeles basin, several recent major earthquakes occurred on what are

being considered "blind" thrust faults: the 1994 Northridge (M6.7), the 1987 Whittier Narrows (M 6.0), and the 1983 Coalinga (M 6.7) earthquakes. Some of these low angle faults are termed detachment faults and may be seismically active (GAM, 1992; Working Group, 1995).

As discussed in Section 2 of this Seismic and Geologic Technical Appendix, detachment faulting and extension comprise a large part of the structural history of the Coachella Valley. The concealed trace of the Santa Rosa Mountain detachment fault occurs beneath the Plan Area west of the Coachella Valley segment of the San Andreas fault. Detailed studies of this detachment fault (Suitt, 1994) near the foothills of Palm Desert, just south of Highway 74 indicate that no activity or reactivation of the fault appears to have occurred during at least the time to form, at a minimum, heavy Stage I and II carbonate deposits and argillic soil horizons within the overlying alluvial materials. The alluvial materials overlying the fault appear to correlate well with similar soils in the Western United States with ages of certainly pre-Holocene (10,000 years) to Late Pleistocene (125,000 years). Additionally, isotropic evidence from portions of this fault in the Borrego Springs area south of the Plan Area, where illite (fault gouge crystalline clays) were dated by the K-Ar method and studied in detail, suggest that there has not been movement on the fault since 12 Ma (M. Shafiqullah, 1989). Based on these studies, the Santa Rosa Mountain detachment fault beneath the Plan Area is thought to be inactive.

Other Strike - Slip faults. Sub-parallel to the San Andreas fault, about 25 miles to the southwest of the City of Coachella lies the San Jacinto fault zone. The San Jacinto fault zone is the most seismically active fault zone in southern California, according to records kept by the Southern California Seismograph Network since 1932, and poses a substantial seismic hazard to the Coachella General Plan Area. The San Jacinto fault zone has been divided into the following segments from north to south: San Bernardino Valley, San Jacinto Valley, Anza, Coyote Creek, Borrego Mountain, Superstition Hills, and Superstition Mountains segments (Working Group, 1995). The San Jacinto fault zone also includes the Clark fault, Buck Ridge fault and the Coyote Creek fault as part of the Anza segment. The Claremont and Casa Loma faults are included in the San Jacinto Valley segment (Working Group, 1995). The epicenter of the Borrego Mountain earthquake of 1968 was located along the Coyote Creek segment of the San Jacinto fault zone. Moderate to large earthquakes (M6 - 7) have occurred along the San Jacinto fault zone, the last one occurring in 1987. The probability of a large earthquake occurring on the Anza segment of the San Jacinto fault zone, the segment closest to Coachella, is considered to be high with a $17 \pm 12\%$ chance of occurring during the next three decades (Working Group, 1995).

Several other active fault zones lie within 50 miles of Coachella: The Elsinore fault zone (45 miles to the southwest); the Pinto Mountain fault (35 miles to the north); the Mojave Desert northwest trending faults (50 miles to the north). The 1992 Landers (M7.3) and the Joshua Tree (M6.1) earthquakes struck faults of the Mojave region only 25-30 miles north of Coachella. The Imperial fault (80 miles to the south of Coachella), suffered the 1940 (M6.9) and the 1979 earthquakes (M6.4). The Banning fault zone, located approximately 56 miles (90 km) north of the Plan Area, represents possible motion that is transferred from the San Andreas or San Jacinto faults. The primary concerns presented from these nearby or adjacent faults or fault zones generally coincides with shaking from moderate to large earthquakes with resulting minor coseismic slip or aseismic creep along the Coachella Valley segment of the San Andreas fault. Fault movement, such as coseismic slip or aseismic creep, was observed within the Coachella Valley segment of the San Andreas fault imme

diately after, several days after and/or for several years after the 1968 Borrego Mountain, 1979 Imperial Valley and 1992 Landers Earthquakes. These earthquakes were located on splays or segments of several of the above fault zones. It should be noted, however, that aseismic creep in association with regional large earthquakes has been relatively minor, but the possible effects on overlying structures (if built) are unknown at present.

3.2.2 Primary Seismic Hazards

Introduction. In order to understand the hazards associated with an earthquake, it is important to understand what an earthquake is and what occurs during such an event. Earthquakes are a release of energy as the thin brittle crust of the earth suddenly breaks in response to stresses imposed on it. These stresses are thought to be a result of the movement of tectonic plates. Tectonic strain leads to stresses which are released by an earthquake. A common analogy is what happens when you slowly bend a tree branch or a pencil until it breaks - you have suddenly released the energy built up by the strain you were exerting on the object. The earthquake is primarily the shaking or seismic wave energy that is transmitted from the fault rupture in all directions. Differing seismic waves can cause buildings to vibrate or shake, or even resonate, which can cause total structure collapse.

Generally, the most widespread, damaging effects of earthquakes are caused by strong ground shaking. Strong ground shaking can catastrophically damage vulnerable structures, most notably large freeway overpasses and unreinforced masonry buildings. It can also trigger a wide variety of secondary hazards such as liquefaction, landslides, local soil subsidence, fire, aqueduct and canal failure, and even toxic or hazardous chemical releases. Consequently, the prediction of areas susceptible to strong ground motion provides invaluable information to safeguard human lives and property against the destructive effects of future damaging earthquakes.

Setting. The location of epicenters of previous earthquakes from 1932 to 1994 in southern California were depicted on Figure 31 and selected southern California earthquakes of magnitude M6.0 or greater that have produced ground shaking in the Plan Area were shown in Tables 2 and 3. This indicates that the General Plan Area has been and will continue to be subjected to earthquake activity.

In the past 150 years of California's recorded earthquake history, no earthquakes of magnitude (M) ≥ 7 have occurred in the neighboring San Bernardino Valley, which may indicate that an earthquake in this area is "overdue". The largest, most recent earthquakes in proximity to the Coachella General Plan Area occurred in Big Bear and Landers on June 28, 1992 ($M6.6$ to $M7.5$) and in Joshua Tree on April 22, 1992 ($M6.3$) (Toppozada, et. al, 1992). Earthquakes occurring on the San Jacinto and San Andreas fault zones would produce significant ground shaking in the Planning Area. Based on its past earthquake history, the Coachella Valley segment of the San Andreas fault has a $22 \pm 12\%$ (high) probability of suffering a large earthquake of $M \geq 7$ during the next three decades (Working Group, 1995). Additionally, the 30 year probability of a $M6.9$ earthquake occurring on the San Bernardino Valley segment of the San Jacinto fault zone is calculated as 37 percent (Working group, 1995 and Toppozada, 1993) and the 30 year probability for a $M7.3$ earthquake occurring on the San Bernardino Mountains segment of the San Andreas fault is 28 percent (Working group, 1995 and Toppozada, 1993). Although estimations of probable earthquakes are important for planning purposes, it should be noted that the maximum credible earthquake for the southern California segment of the San Andreas fault is calculated as $M8.3$ (Davis,

et. al. 1982). In summary, the Coachella General Plan Area is located in a seismically active area of southern California and potential impacts from local or distant large event earthquakes is highly likely. The principal seismic hazards that may impact the Planning Area are discussed below.

3.2.2.1 Explanation of Epicenter, Focus and Magnitude. One of the primary ways that seismologists communicate information about earthquakes is by determining their epicenter, focus, magnitude and intensity. Earthquake shaking can be measured by 1) magnitude, and 2) intensity. The earthquake magnitude is a measure of the total seismic shaking energy released by the earthquake. A common analogy may be to the wattage rating of a light bulb. The magnitude of an earthquake has only one "true value" but different seismometers around the globe may make several different estimates of the magnitude by measuring different types of seismic waves generated from a particular event. Intensity, however, is a measure of the strength of the shaking at the specific location. As in the light bulb analogy, the intensity of the earthquake varies away from the source (GAM, 1992). It is generally strongest closest to the source, and weaker far away from the source.

Epicenter and Focus

When an earthquake occurs, the crust initially breaks at depth, called the focus, and continues along the fault, sometimes reaching the surface. From this fault rupture surface or area, energy in the form of seismic waves propagates in all directions away from the source. The primary and secondary waves associated with this energy release are called the body waves. Body waves travel through the crust and also reach the earth's surface, creating surface waves. Body and surface waves cause the vertical and horizontal motion associated with an earthquake. The rolling motion is often a result of the complex interaction of the surface waves. The epicenter of an earthquake is the point directly above the focus of an earthquake, on the surface of the earth where we can easily reference geographically. Most earthquakes in southern California initiate at depths of 6 to 15 km or 4 to 10 miles below the surface.

Magnitude Scales

The extent of ground shaking associated with an earthquake is dependent upon the size of the earthquake and the geological material of the underlying area. Two scales are presently in use in the United States when describing the size of earthquakes. The most familiar is the Richter scale, developed by Beno Gutenberg and Charles Richter in the 1930's. The second is called the Moment magnitude scale. The size of an earthquake has traditionally been reported using the Richter magnitude scale, defined in terms of the maximum amplitude of seismic motion recorded on a Wood-Anderson seismometer at a distance of 100 km from the source. (Johnson and others, 1994, AEG short course; Jones, L.M, 1995). Generally, the Moment magnitude scale is used for large magnitude earthquakes (i.e., $M > 6$). The Moment magnitude scale is calculated based on the area of fault rupture, the average amount of slip, and the shear modulus of the rocks offset during the earthquake (Hauksson, 1992, p. 170). One of the observations of earthquake magnitude, is the direct relationship between the length of the fault and the magnitude of the earthquake. Therefore, a 'longer length' of a fault is indicative of a large magnitude earthquake. The fault lengths are also used and considered in calculations estimating the probable magnitude of large earthquakes along fault zones. A difficult aspect to this correlation is the presence of "flat" faults called thrust or detachment faults that are not necessarily visible on the surface. The 1994 Northridge earthquake occurred on one of these thrust faults. The Richter and moment magnitude scales are logarithmic. Therefore, the amplitude of shaking resulting from a M6

earthquake is 10 times greater than a M5 earthquake. Each whole number increase in magnitude is also equivalent to about 32 times more energy than the precedent whole number. Therefore, a M6.0 earthquake releases 32 times more energy than a M5.0 and about 1000 times more energy than a M4.0 (Jones, 1995).

3.2.2.2 Earthquake Effects - Shaking Intensity Measurements. The intensity of shaking is usually greatest close to the source, but sometimes is amplified strongly at other sites away from the source. Seismic intensity may locally increase because of differences in the seismic wave propagation speeds in different earth materials. In general, when the seismic waves move from a region of high seismic velocity, as in bedrock areas to regions of low seismicity, as in a soft soil such as clay or mud, the amplitude will increase. The relative amplification of the expected seismic shaking amplitudes can be estimated at various surface locations based upon geologic mapping of the soil and rock types, their respective seismic velocities and densities (GAM, 1992).

Two other parameters that are measured in estimating shaking intensity during an earthquake are 1) amplitude and 2) duration. On seismometers, the amplitude represents the strength of the seismic waves as measured by the amount of ground movement, recorded from peak to trough. The duration represents the length of time that the strong shaking persists at a given location (GAM, 1992). Table 3 shows a list of historical earthquakes in the southern California area including the duration of shaking. A longer duration of shaking would be expected to result in a greater seismic hazard and is most severe during large magnitude earthquakes.

Modified Mercalli Intensity Scale

The Modified Mercalli Intensity Scale is designed to quantify damage caused during an earthquake by the descriptive nature of the type of failures that occurred. Table 5 depicts the Scale with corresponding intensity levels or rating of the severity of ground motion at a specific location. The maximum intensities of the Modified Mercalli Intensity Scale may not be coincident with the location of the epicenter since the damage that can occur during an earthquake is dependent on other factors as well. Some of the main factors responsible for the greatest damage during an earthquake are the type of soil and the construction type or condition of buildings. A recent example is the damage incurred during the 1989 Loma Prieta earthquake where the greatest damage occurred in the San Francisco Bay area, some 120 miles north of the epicenter. Of course, if there occurs a greater population density and amount of buildings in an area other than at the epicenter, damage would be greater in the more densely populated region.

One of the methods of measuring ground shaking amplitude during an earthquake is by measuring ground acceleration in terms of gravity. A greater discussion of this measurement follows in the next section.

3.2.2.3 Strong Ground Motion and Acceleration. Ground shaking or strong ground motion is the primary effect of an earthquake. Although much emphasis has been placed on surface or fault rupture, the shaking effects of an earthquake, which include frequency, resonance, basin amplification and directivity, create the most widespread damage and greatest loss of life, sometimes even hundreds of miles from the epicenter. It was the strong ground shaking that resulted in a loss of at least 10,000 lives in Mexico City in 1985, which was located some 200 miles away from the epicenter. The Uniform Building Code or UBC has greatly improved the reduction of this hazard in California. However, many unreinforced

Table 5. Modified Mercalli Intensity Scale indicating general relationship between greatest measured Intensity and Magnitude. From U. S. Geological Survey Circular 1045, 1990.

I No felt by people, except rarely under especially favorable circumstances Magnitude, M	VII Difficult to stand. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in badly designed or poorly built buildings. Noticed by drivers of automobiles. Hanging objects quiver. Furniture broken. Weak chimneys broken. Damage to masonry; fall of plaster, loose bricks, stones, tiles, and unbraced parapets. Small slides and caving in along sand or gravel banks. Large bells ring.
II Felt indoors only by persons at rest, especially on upper floors. Some hanging objects may swing. M 3-	VIII People frightened. Damage slight in specially designed structures; - M 6 considerable in ordinary substantial buildings, partial collapse, great in poorly built structures. Steering of automobiles affected. Damage or partial collapse to some masonry and stucco. Failure of some chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed pilings broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.
III Felt indoors by several. Hanging objects may swing slightly. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.	IX General panic. Damage considerable in specially designed structure; great in substantial buildings, with some collapse. General damage to foundations; frame structures, if not bolted, shifted off foundations and thrown out of plumb. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground; liquefaction. - M 7
IV Felt indoors by many, outdoors by few. Hanging objects swing. Vibration like passing of heavy trucks; sensation of jolt like a heavy ball striking the walls. Standing automobiles rock. Windows, dishes, doors rattle. Wooden walls and frame may creak. M 4-	X Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Landslides on river banks and steep slopes considerable. Water splashed onto banks of canals, rivers, lakes. Sand and mud shifted horizontally on beaches and fault land. Rails bent slightly.
V Felt indoors and outdoors by nearly everyone; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable object displaced or upset; some dishes and glassware broken. Doors swing; shutters, pictures move. Pendulum clocks stop, start, change rate. Swaying of tall trees and poles sometimes noticed.	XI Few, if any masonry structures remain standing. Bridges destroyed. Broad fissures in ground; earth slumps and landslides widespread. - M 8 Underground pipelines completely out of service. Rails bent greatly.
VI Felt by all. Damage slight. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks and books fall off shelves; pictures off walls. Furniture moved or overturned. M 5- Weak plaster and masonry cracked.	XII Damage nearly total. Waves seen on ground surfaces. Large rock masses displaced. Line of sight and level distorted. Objects thrown upward into the air.

masonry buildings (URM) still exist that were built prior to the enactment of the earthquake-resistant building codes (GAM, 1992). Such buildings are notoriously vulnerable to earthquake damages, even collapse. Other vulnerable building types, such as older tilt-up and non-ductile concrete buildings, have been recognized as problematic following recent large earthquakes. Building Codes are being revised to reduce the vulnerability of all types of buildings.

Plan Area Quantification of Peak Horizontal Ground Accelerations (PGA)

The unit often used for describing the amplitude of shaking is peak ground acceleration (PGA). Ground acceleration values are measured relative to the unit of gravity (g), which is the "force" that pulls an object back to the ground when tossed up into the air. Acceleration is used to represent the force induced by the shaking. The acceleration of 1.0 g would be equivalent to a car traveling 100 meters (328 feet) from rest in just 4.5 seconds (Bolt, 1988), or completing a 1/4 mile drag race in "9 seconds flat". Accelerograms can actually measure the acceleration experienced during an earthquake. Seismic provisions for the UBC has primarily focused on requiring design considerations for horizontal ground accelerations since all buildings must be designed to stand under their own weight, which represents a vertical acceleration of 1g.

In order to quantify the seismic hazard as a result of ground shaking in the General Plan Area, peak horizontal ground accelerations (PGA)s were calculated using various parameters (Table 6). These values were calculated using the method described by Joyner and Fumal (U.S.G.S. Professional Paper 1360, 1985) and include the appropriate shaking attenuation relations. The PGAs shown in Table 6, are for rock sites. However, for acceleration, statistical evaluations of strong ground motion have found that the difference between soil and rock ground acceleration values near the epicenter ("near field") are insignificant. In contrast, there exist substantial amplification effect for peak horizontal ground velocity, which is a more relevant measure of evaluating shaking levels that may inflict damage on structures (ATC 3-06). PGAs were calculated, instead of velocities, because PGAs are in more common use for seismic hazard studies, as well as for use in building codes. Peak ground velocities can be computed using similar shaking attenuation relations and the results adjusted according to the appropriate soil conditions.

For the Coachella General Plan Area, PGA values exceeding 60% of gravity (0.6g) are expected for a 100-year return period, and PGA values exceeding 100% of gravity (1.0g) are expected for a 475-year return period, based on the occurrence of a large earthquake of M7-8 on the San Andreas fault (Table 6). The Southern California Earthquake Center (SCEC) and the Scientists of the Working Group on California Earthquake Probabilities have also published ground shaking values that state that there is a 50% probability of shaking exceeding 20% of gravity during the next thirty years (Figure 33). The SCEC values equate to a 70% chance of exceedance for a 50-year interval. Therefore, proposed development within the General Plan Area should be prepared for large expected levels of ground shaking: 60% to 100% of gravity (0.6g to 1.0g), which exceed the current UBC Zone IV design values of 40% of gravity (0.4g). It should be noted that 20% of gravity is damaging to most types of construction, and maybe destructive to weak or poorly constructed buildings.

Table 6 depicts Peak Horizontal Ground Accelerations (PGA) computed for three different return periods: 100-year, 300-year and 475 year return periods or occurrence probabilities for faults anticipated to generate the highest ground motions in the Plan Area. The site distance is measured from the city of Coachella downtown area to the nearest point on the

Tables 6 and 7. Coachella General Plan Area Seismic Hazard Analysis as measured from the downtown area. Table 6 represents Peak Horizontal Ground Acceleration, whereas Table 7 represents Effective Peak Horizontal Ground Acceleration values. These Tables are not recommended for use in lieu of "site specific" seismic hazard analysis.

Table 6 PEAK VALUES

Fault Name [Slip Rate]	Distance to Site	Fault Length	Average Slip	Return Period	Moment Magnitude	Peak Acceleration		Duration (sec)
						50%	475 yr	
San Andreas (Coachella Segment) [25 mm/yr]	2.54 mi 4.09 km	113 km	125 cm	100 yr	7.1	.59	.98	30
		341 km	375 cm	300 yr	7.7	.77	1.00	95
		540 km	594 cm	475 yr	8.0	.94	.94	150
San Jacinto (Anza Segment) [12 mm/yr]	21.3 mi 35.2 km	55 km	60 cm	100 yr	6.7	.10	.17	15
		164 km	180 cm	300 yr	7.3	.14	.17	45
		259 km	285 cm	475 yr	7.6	.17	.17	70
Elsinore [7 mm/yr]	45.6 mi 73.4 km	32 km	35 cm	100 yr	6.4	.03	.055	9
		95 km	105 cm	300 yr	7.0	.045	.055	25
		106 km	116 cm	475 yr	7.2	.05	.05	30

Table 7 EFFECTIVE VALUES

Fault Name [Slip Rate]	Distance to Site	Fault Length	Average Slip	Return Period	Moment Magnitude	Peak Acceleration		Duration (sec)
						50%	475 yr	
San Andreas (Coachella Segment) [25 mm/yr]	2.54 mi 4.09 km	113 km	125 cm	100 yr	7.1	.44	.74	30
		341 km	375 cm	300 yr	7.7	.58	.75	95
		540 km	594 cm	475 yr	8.0	.71	.71	150
San Jacinto (Anza Segment) [12 mm/yr]	21.3 mi 35.2 km	55 km	60 cm	100 yr	6.7	.08	.13	15
		164 km	180 cm	300 yr	7.3	.11	.13	45
		259 km	285 cm	475 yr	7.6	.13	.13	70
Elsinore [7 mm/yr]	45.6 mi 73.4 km	32 km	35 cm	100 yr	6.4	.04	.06	9
		95 km	105 cm	300 yr	7.0	.05	.06	25
		106 km	116 cm	475 yr	7.2	.05	.05	30

surface fault trace. Three fault traces were used to calculate the expected PGAs from a M7-8 earthquake along the length of the following faults: the Coachella Valley segment of the San Andreas fault, the Anza segment of the San Jacinto fault zone and the Elsinore fault zone. The fault length represents the length of the anticipated seismogenic fault rupture, which is directly proportional to earthquake magnitude for strike-slip faults. As explained earlier in this subsection, this method of estimating magnitude may not work well for "flat" faults such as thrust or detachment faults. The average slip for each fault zone (i.e., 125 cm for a 100-year return period for the Coachella Valley segment of the San Andreas fault) is a measure of the average fault displacement for the earthquake on a particular fault trace for a specific frequency of occurrence or return period for earthquakes of this size, assuming a characteristic earthquake model in which all events are of the chosen size. This value is one-half the fault slip rate value because the empirical shaking equations are for "median" values, that is 50% are greater, and 50% are less. The Moment magnitude scale is used in these calculations to better measure the earthquake energy. Moment magnitude does not saturate at large values due to seismograph bandwidth limitations.

Table 6 also indicates Peak horizontal Ground Accelerations (PGA) computed for three different periods or occurrence probabilities for the median and design level. The median PGA value represents a 50% chance of exceedance at the given return period. The design level value PGA value represents a 10% chance of exceedance in a 50-year interval or 475 year return period. The values shown were calculated for rock sites or deep alluvium sites. Some amplification may occur for shallow soil sites, but these are minor effects in the near field (close to the epicenter) of large earthquakes. The 475-year value exceeds the median value for return periods less than 475 years because the relatively more frequent occurrence of the smaller events increases the probability of experiencing shaking levels above the median level. For the 10% chance of exceedance in 50 years, the PGA was adjusted by the appropriate number of standard deviations found from the statistical correlation's. An important result of this type of analysis is that the expected PGA for the fixed probability of occurrence is relatively constant whether the shaking derives from several smaller events or just one "Big One".

Table 7 shows Effective Peak Ground Acceleration (EPGA) values, often used by engineers for design because it is considered more representative of the level of shaking at response frequencies relevant for buildings. The true peak accelerations are often associated with isolated, high frequency spikes on the seismogram. A more useful seismic hazard analysis for engineering purposes would compute shaking response spectra which show shaking levels over a range of response frequencies appropriate for structures. The EPGA values are a simple, first order calculation of the seismic shaking that would be expected. EPGA is also often used to scale "standard" design response spectra in earthquake engineering.

Recent studies show that for very strong shaking at a site near the epicenter, the soil behaves in a non-linear fashion. The non-linear behavior is a result of inelastic deformation and sometimes it is the result of liquefaction within shallow soils. The non-linear effect is expected to reduce the amplitude of strong shaking although the possible ground failure associated with the non-linearity may be just as, or more destructive than the shaking alone. Preliminary results from investigations of these effects in large southern California earthquakes showed the effects were observable only in sites underlain by shallow alluvium. Sites underlain by deep alluvium or bedrock sites did not show this effect. The Lawrence Livermore National Laboratory is working on computer codes that may aid engineers with non-linear seismic structural analysis computations (Lawrence Livermore National Laboratory, March 1996 web page).

Peak ground accelerations, peak displacements or peak ground velocities are ways to quantitatively measure the seismic intensity. However, this method of measurement ignores the duration effect of an earthquake (GAM, 1992). Damage due to seismic shaking is dependent also on the duration of strong shaking as well as the amplitude of ground motion. Therefore, Tables 6 and 7 have estimated the duration of strong ground shaking for the "causative faults" and corresponding magnitude earthquakes listed. The duration value is roughly proportional to the length of the fault rupture, which is directly proportional to the

earthquake magnitude. The duration results from the finite time it takes for the earthquake fault rupture to propagate the entire length of the active fault surface. The rupture propagation velocity is slightly lower than the seismic velocity of shear waves, the same type of seismic waves that tend to be most destructive. Scattering and other effects tend to increase the duration, but are second-order effects and considered within the uncertainties of the preliminary analysis presented. Since it is not certain whether the fault rupture will start at one end of the fault and propagate the entire fault length to the other end, or whether it will start in the middle and propagate outwards to both ends simultaneously, the actual duration may be somewhere between the value shown and one-half this value.

In summary, it is evident that there is a high potential for both PGA and EPGA (ground acceleration) to exceed the building code design value of 0.4g in the Coachella General Plan Area due to the proximity to the San Andreas fault zone. As this fault zone is likely to experience large earthquakes ($M > 7$) with rupture of long fault segments, the duration of shaking is also likely to be substantial (30 seconds or more). Consequently, buildings and other critical facilities in the Coachella Valley should be designed and constructed to withstand such severe ground motions. New building codes will incorporate the higher expected shaking levels for sites located in the "near field" fault areas.

Frequency and Resonance

Seismic waves have different frequencies depending on the size and rupture complexity of the earthquake, the distance to a site and the path, and material through which the seismic wave is propagated. Generally, if a site is close to the source of the earthquake, termed "near field", the seismic waves include strong, high frequency waves that tend to be damaging to shorter (low-rise) buildings. Generally, at a greater distance from the epicenter, high frequency waves are attenuated (disappear) and long periods remain. The long period wave forms associated with surface waves tend to be damaging to high-rise buildings and buildings with large floor areas, bridges, dams and other large structures (LA County, 1990).

Every structure, including surficial soil deposits, has a natural response frequency which is a measure of how rapidly the structure would vibrate if struck with a very strong and instantaneous force (GAM, 1992). A very damaging phenomenon called resonance can occur when the frequency of earthquake waves, the site, and the building periods coincide. The structure will resonate like an echo chamber leading to an increase in amplitude and duration of shaking. Structures experiencing resonance may suffer severe damage or collapse. Resonance was one of the factors that led to the tragic number of deaths and destruction that occurred in Mexico City during the 1985 earthquake located some 200 miles away. During this earthquake, modern buildings in one small area were totally destroyed while similar buildings located only a few blocks away were undamaged. The presence of 'soft' soils, like bay or lake muds, such as might occur in "old Lake Cahuilla" within the Plan Area, prolong shaking and can create a resonant condition. Mexico City lies on ancient lake bed

muds and created a resonant condition. A similar situation occurred in Oakland, California, during the 1989 Loma Prieta earthquake causing the collapse of the Cypress freeway structure (GAM, 1992).

Amplification

Basin Amplification is another aspect of how the seismic waves interact with the ground and the differing materials through which they propagate. Typically, it would be expected that the edges of a basin, such as the those areas rimming the Coachella valley, would receive the greatest amplification of the seismic waves, and that the seismic waves may be dampened in the center of the basin or valley. However, there is no way to predict how these waves would interact in the Plan Area since the directivity of the earthquake, surface material and magnitude and duration of the earthquake would all be factors in amplifying or dampening the effect of seismic waves.

Directivity

In general, it is expected that ground acceleration values decrease with greater distance from the epicenter. Directivity, however, is the focus of energy along the direction of the ground rupture. During the 1994 Northridge earthquake, it was the directivity of motion towards the northern Santa Susana Mountains that was the greatest controlling factor in the amount of ground shaking (Scientists, 1994). Soft soils may have also produced larger ground motions locally (Scientists, 1994). One of the main differences between the 1995 Kobe earthquake in Japan and the 1994 Northridge earthquake was directivity (NOVA, 1996 - video). In the Northridge earthquake, the ground motion was directed towards the Santa Susana Mountains to the north away from cities. In the Kobe earthquake, the ground motion was directed right under the city. The significance of an earthquake with directivity of shaking effects in the Coachella General Plan Area would most likely be a result of an earthquake occurring on the San Andreas fault. Directivity effects were observed, however, during the Imperial Valley earthquakes of 1940 and 1979 on strike-slip faults. In 1940, the rupture propagated away from El Centro, resulting in lower shaking amplitudes. In 1979, the rupture propagated towards El Centro, resulting in stronger shaking amplitudes but shorter durations. Directivity from "near field" earthquakes generated from the San Andreas fault will present ground motion concerns within the General Plan Area.

3.2.2.4 Probabilistic Versus Deterministic Analysis of PGA. The probabilistic method is used to prioritize areas where stringent seismic design or increased mitigation is warranted. The probabilistic method uses the critical distance of a particular location to an "active" fault to evaluate the annual probability of expected ground motion. The probabilistic method assigns lower annual probabilities of exceedance to the larger values of peak ground acceleration (PGA) or peak ground velocity (PGV) expected from a catastrophic earthquake. The probabilistic method typically uses low, 50-year recurrence times of exceeding a particular ground motion for ordinary structures and 250 year recurrence intervals for siting and designing critical facilities such as hospitals, communication centers. The probabilistic method can be used to prioritize areas where stringent planning is needed but does require extremely accurate and detailed knowledge of the fault zones. Additionally, this method may not be reliable for earthquakes occurring on "flat" faults such as the Northridge and Whittier Narrows earthquakes. (LA County, 1990).

The probabilistic method is used to estimate the level of shaking expected at a site for a specified recurrence interval or exceedance probability. The probabilistic method includes all possible earthquake faults and source zones that may affect the site, usually located within 100 km. The deterministic method is used to estimate the level of shaking expected at

a site or in a region, based on only one, or some small number of specific faults or source zones. It is a scenario and may or may not consider a likelihood approach. The probabilistic method can map expected shaking for a given probability of occurrence, or the variation of shaking versus likelihood or return period. The deterministic method can map shaking and other hazards over a region due to a specific scenario and is very useful for infrastructure and system loss evaluations. Depending upon site specific requirements, both methods can be used within the General Plan Area to evaluate ground motion parameters.

3.2.3 Secondary Effects of Seismic Hazards - Earthquake Induced Ground Failure

Introduction. Many past earthquakes in southern California were accompanied by either costly or nearly catastrophic damage from earthquake-induced ground failure including liquefaction, and lateral spreading, which is a particularly damaging form of liquefaction that results in shallow flow failures on gently-dipping ground. Additionally, during large earthquakes, seismically induced settlement is a concern. Ground failure of artificial fill may also damage bridge approaches and roadways. Because damaging liquefaction can be induced with seismic intensities of only $MM = VII$, and predictive ground motion maps (Figure 33) indicate such intensities can occur relatively frequently, the region is extremely vulnerable to future property damage from earthquake-induced ground failure.

The most common type of secondary seismic hazards are liquefaction and lateral spreading, which includes lurching type failures (Figure 45). Liquefaction often results in the most severe disruption of near-surface materials. Heavy structures tend to settle or overturn during liquefaction, causing severe structural and foundational distress (Figure 46). Structures may settle up to several feet below grade while buoyant buried fuel tanks may rise to the surface. As with fault rupture, liquefaction and ground failure can impact utility, flood control and transportation lifelines. Damaged roadways could prevent access for emergency response vehicles and complicate evacuation operations. Severed water distribution lines can impair fire fighting capability or, if associated with waste water line breaks, might contaminate the drinking water supply (Figure 46). Likewise, certain utility lifelines may cause explosions or fires. The potential impact of earthquake-induced ground failure including both liquefaction and landslides makes assessment of all areas prone to such phenomenon vital to regional and disaster response planners.

3.2.3.1 Liquefaction Hazards. Several state-of-the-art procedures exist to regionally delineate areas prone to ground failure. The fundamental basis of each method is essentially identical with all methods requiring the regional compilation of two component variables: 1) the distribution of sediments prone to liquefaction, represented by youthful, cohesionless, fine-grained granular surficial and/or subsurface materials, and 2) the distribution of shallow or perched ground water. A discussion of seismically induced ground failure is presented in the following subsections.

3.2.3.1.1 Shallow and Semi-Perched Ground Water Conditions. The groundwater conditions in the Coachella Valley have been extensively investigated. By the early 1900's, several thousand acres of irrigated farmland existed in the Valley, supplied by over 400 wells. Limitations in the water supply became evident when groundwater levels began to decline with increased agricultural use. Thus, in 1918, the Coachella Valley County Water District was formed, primarily for the purpose of securing imported water supplies (Department of Water Resources, 1964).



Figure 45. Typical seismically-induced slump block or lurching failures. Ruptured canal lining along faults in the southern part of Imperial Valley damaged in the 1979 earthquake. Lateral ground displacement during an earthquake could cause major failure of water systems because of seismic motion anywhere in the Coachella Valley region. Failure of water systems and lakes, such as being planned for the Entertainment Zone, are a potential concern because of the horizontal ground motion that would be associated with motion on faults in the entire Salton Trough region. From: Sharp, et. al., 1982.

LIQUEFACTION HAZARDS

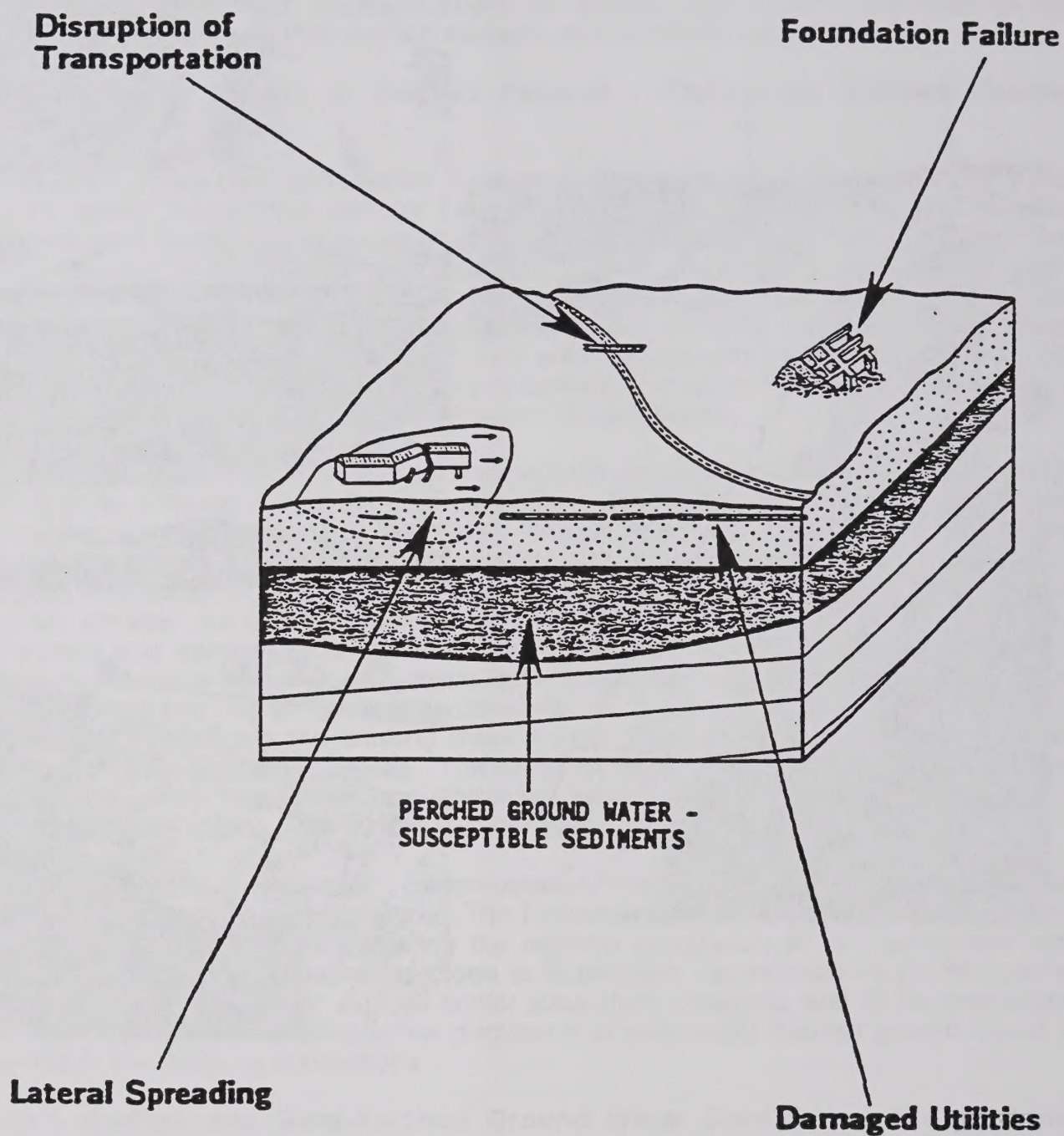
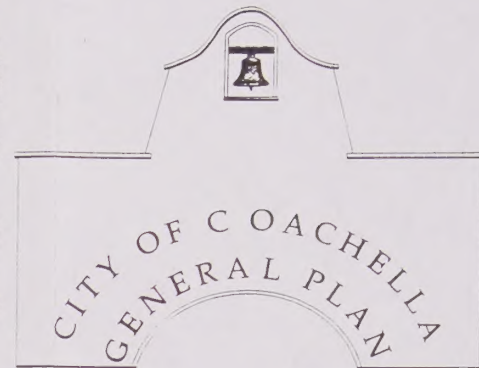
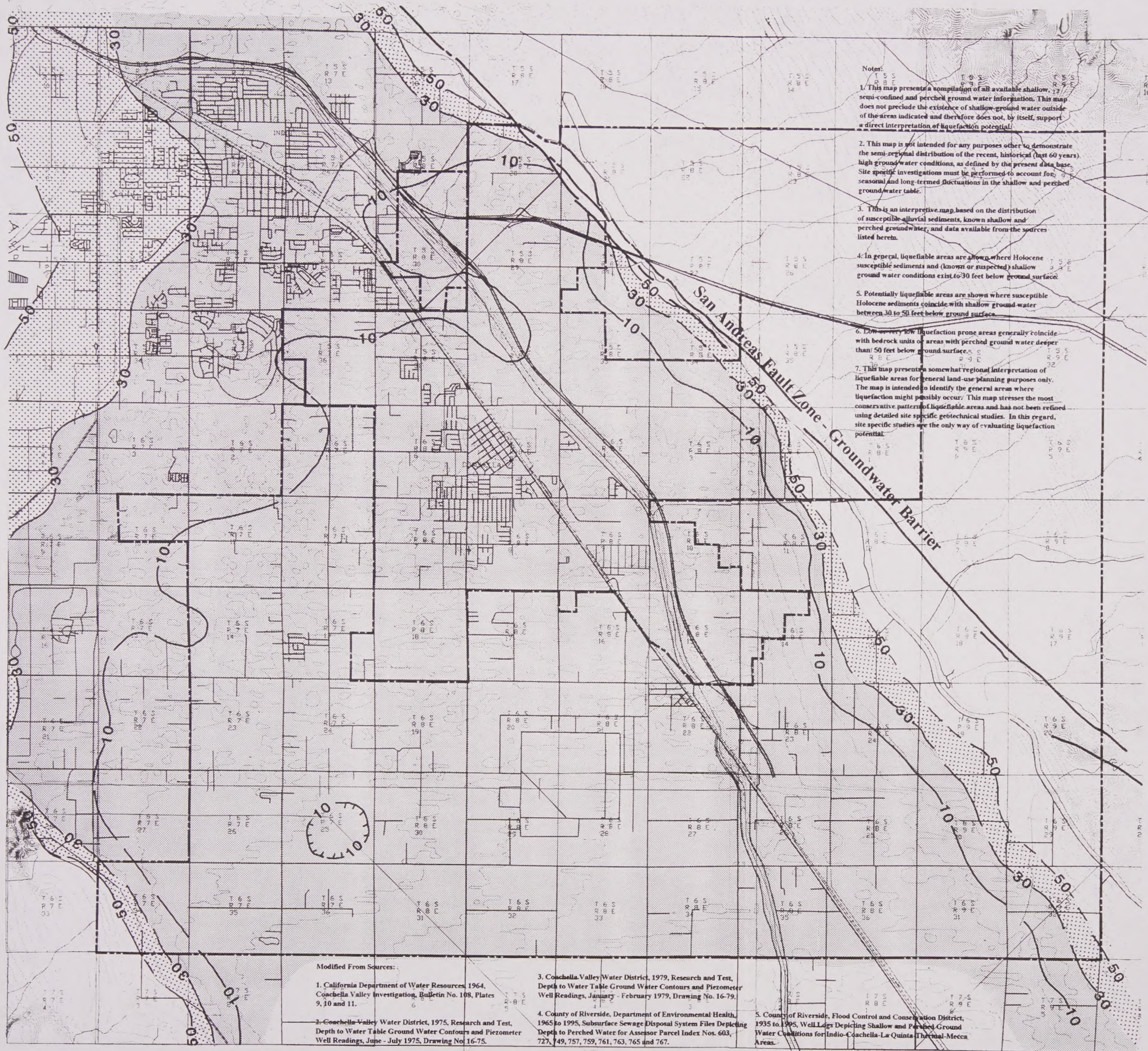


Figure 46. Typical liquefaction hazards that should be anticipated for the General Plan Area. From LA County, 1990.



Explanation

Shallow and Perched Ground Water

10' Depth to Ground Water - Shallow Well Determined

50' Depth to Ground Water - Approximately Located

Explanation

Generalized Liquefaction Potential

Liquefiable Area

Potentially Liquefiable Areas

Low to Very Low Liquefaction Potential

Coachella General Plan Area

Figure 47

Shallow and Perched Ground Water and Generalized Liquefaction Potential



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Groundwater contour maps have been prepared for the Coachella Valley with well information gathered from the late 1930's to the early 1990's. These maps, as well as accompanied studies, indicate that there are two main, water bearing aquifers in the Thermal Subarea of the Whitewater River (Indio) Subbasin including, a lower aquifer, and an upper aquifer with a shallow semi-perched or perched water table to within several feet or inches of the ground surface. Groundwater conditions are summarized in Section 2.3.2. Water is typically being withdrawn from the lower aquifer and utilized for domestic, commercial and agricultural uses, which tends to recharge the semi perched, shallow groundwater table.

Methodology and Limitations of Groundwater Data

Based on information received from the Coachella Valley Water District, an historical Shallow and Perched Groundwater and Generalized Liquefaction Potential Map (Figure 47) was prepared for the General Plan Area. Shallow groundwater is defined as less than or equal to 50 feet below the ground surface. The groundwater data base used in preparation of Figure 47 is generally derived from groundwater contour mapping performed by the Coachella Valley Water District (CVWD) during the mid to late 1970's. The CVWD placed over a hundred shallow piezometers in the Valley to study the water quality and depth of shallow perched water. These maps were updated with well data obtained from the Riverside County Department of Health Services and the Riverside County Flood Control and Conservation District and used to compile Figure 47 historical shallow groundwater depths. This map reflects the most conservative depth to shallow or high groundwater from the late 1930's to 1995.

Shallow, historical groundwater was plotted on Figure 47 to specifically produce a Generalized Liquefaction Potential Map by comparing areas of shallow groundwater with sediments susceptible to ground failure. It will serve only as an information source that can be periodically updated with new information. Three points must be emphasized with regard to the limitations of this map. The first is that future changes in CVWD groundwater management policy could elevate or lower regional groundwater and perched water levels. Secondly, the map does not address seasonal fluctuations due to increased precipitation. Lastly, the map is constrained by the existing data base and the historical groundwater level nature of the map. This last point makes the map unsuitable for site-specific applications, due to the highly irregular and localized nature of perched and semi-perched groundwater.

3.2.3.1.2 Liquefaction Potential. Earthquake induced ground failure is generally designated as a secondary seismic hazard and is typically classified in accordance with the severity of deformation sustained by the sediment and the degree of saturation of the sediment. The most common type of secondary seismic hazards include differential dynamic settlement in dry to moist sediments, and liquefaction, such as differential settlement, sand boils, lateral spreading and lurching in saturated sediments as described below.

- **Differential Dynamic Settlement:** This ground failure mode occurs in dry to partially saturated sediments, and is caused by the subsurface densification or consolidation of loose, cohesionless sediments. Without full saturation, the sediment material retains partial internal shear strength during sustained earthquake shaking, creating displacements of up to one meter. Settlement may occur in either natural sediments or artificially emplaced fill.

- **Liquefaction:** This ground failure mode is the most severe. It is caused by the total loss of internal shear strength during ground shaking. High pore pressures built up in the sediments during repeated vibration cause the sediment to behave as liquid, especially when ground shaking continues for long durations. Liquefaction is often accompanied by sand boils and ground lurching, which cause fissuring and cracking of the ground surface as surface waves pass through these areas. Sand boils often start and continue to "erupt" after the shaking stops. If liquefaction occurs on gently sloping terrain, extremely large lateral displacements may occur within near surface sediments and within the lower, subsurface sediments that actually control the extent of the lateral spread. Types of liquefaction failures that commonly occur on sloping or nearly flat alluvial plains include flow failures, lurching and lateral spreading. Also, flat-lying areas adjacent to a "free face" such as a drainage ditch or river channel, may suffer lateral spread failures (Figure 45).

Methodology and Interpretation of Liquefaction Potential

Methodology. Figure 47 includes a depiction of Generalized Liquefaction Potential in the General Plan Area as it relates to valley wide alluvial sediments and shallow and perched ground water. It is based on an interpretation of areas where subsurface conditions appear conducive to liquefaction, lateral spreading, and other water-saturated ground failure modes.

The depths to groundwater chosen to represent liquefaction potential is based on the work of others. Studies have generally indicated that liquefaction potential occurs where depth of groundwater is less than 50 feet below ground surface (Sherif and Ishibashi, 1978), with a high, moderate and low potential for liquefaction at groundwater depths of 10, 10 to 30, and 30 to 50 feet below ground surface, respectively (Tinsley, et. al., 1985 and Youd, et. al., 1978).

Interpretation. Based on the regional nature of the Generalized Liquefaction Potential Map and the consideration of interpretations utilized by the studies above, the following criteria are used to establish relative liquefaction potential on Figure 47:

Liquefiable Sediments (0 to 30 feet Depth to Groundwater)

The designation as liquefiable can be interpreted to define a high to moderate potential. The apparent areal distribution of liquefiable sediments is correlated with the following:

- Physiography - marshes, canals, alluvial fans, valley fill.
- Flood control projects.
- Ground water impediments (barriers to ground water flow, e.g., faults, lateral changes in sediment permeability, or juxtaposition with impervious bedrock).
- The distribution of the groundwater borehole data set.

Potentially Liquefiable Sediments (30 to 50 feet Depth to Groundwater)

A potentially liquefiable designation identifies areas with relatively low potential for liquefaction. In addition to the 30 to 50-foot groundwater depth criteria, potentially liquefiable areas are also identified where coarse-grained sediments, such as sand and gravels, are in contact with shallow groundwater.

Low to Very Low Liquefaction Potential

Areas underlain by bedrock, including consolidated sediments, or where groundwater is deeper than 50 feet below the ground surface, possess a low to very low liquefaction potential.

Uses and Limitations of the Generalized Liquefaction Potential Map

General Plan Areas with liquefaction potential may be more or less extensive than estimated from the data base used in this study. This is because the engineering characteristics of alluvial materials, such as the packing and size distribution, needs to be investigated directly at each site. Techniques such as the standard penetration test (ASTM D1586) recommended by Seed, et al., 1985 provide a quick, accurate, and practical method for such assessments. Also, geotechnical studies, within some portions of the Liquefiable Areas on Figure 47, indicate that based on drilling and engineering calculations no liquefaction hazard exists (Kupferman, 1995).

The thickness of susceptible sediment layers is the least accurate parameter of the Generalized Liquefaction Potential Map of the General Plan Area. The alluvial thickness can be important because even though an area might be identified as liquefiable, the susceptible alluvial unit may be situated above the water table, and thus preclude the saturation factor necessary for liquefaction. Furthermore, because the total sum of internal strain within the material increases with the thickness of the susceptible unit, some surficial or subsurface layers may be too thin to cause damaging settlements.

Lastly, the areas of shallow water used to produce the liquefaction potential map does not indicate what the susceptibility for liquefaction might be if management practices change. Recharge practices and cessation of groundwater pumping increases the potential for liquefaction. Also, seasonal wet periods have greater potential due to ground saturation.

3.2.3.2 Earthquake-Induced Ground Settlement. Damaging settlements can occur in areas outside of those identified as having liquefaction potential. During very large earthquakes, it is possible for subsidence or seismically induced settlement to occur in loose granular soils in the flat or gently sloped portion of the General Plan Areas that border the valley. Ground settlements are generally less severe than those experienced during liquefaction, however, displacements of a meter or more have occurred during some large earthquakes, and settlements of 5 to 30 centimeters are rather common (EERI, 1986). Special delineation was not considered necessary for earthquake-induced settlements because all alluvial areas are susceptible to this failure type, especially those areas where depth to bedrock varies abruptly.

3.3 Earthquake-Induced Flood and Inundation Hazard

The General Plan Area is vulnerable to a wide range of flood hazards, including those caused by earthquakes, intense storms or heavy rainfall, and failure of man-made structures. Although the impact from the 1940 and 1979 Imperial Valley earthquakes (Figure 45) was relatively minor (as compared to other areas of southern California with a similar magnitude earthquake), in the southern portion of the Coachella Valley, ruptured canal linings, drainage channel bank failures, and damage to above ground water and oil storage tanks (Figure 48) could be a common occurrence with a moderate to large seismic event on the Coachella Valley segment of the San Andreas fault. Earthquake induced flooding most commonly occurs with dam, levee, pipeline, canal or aqueduct failures, and with seiches

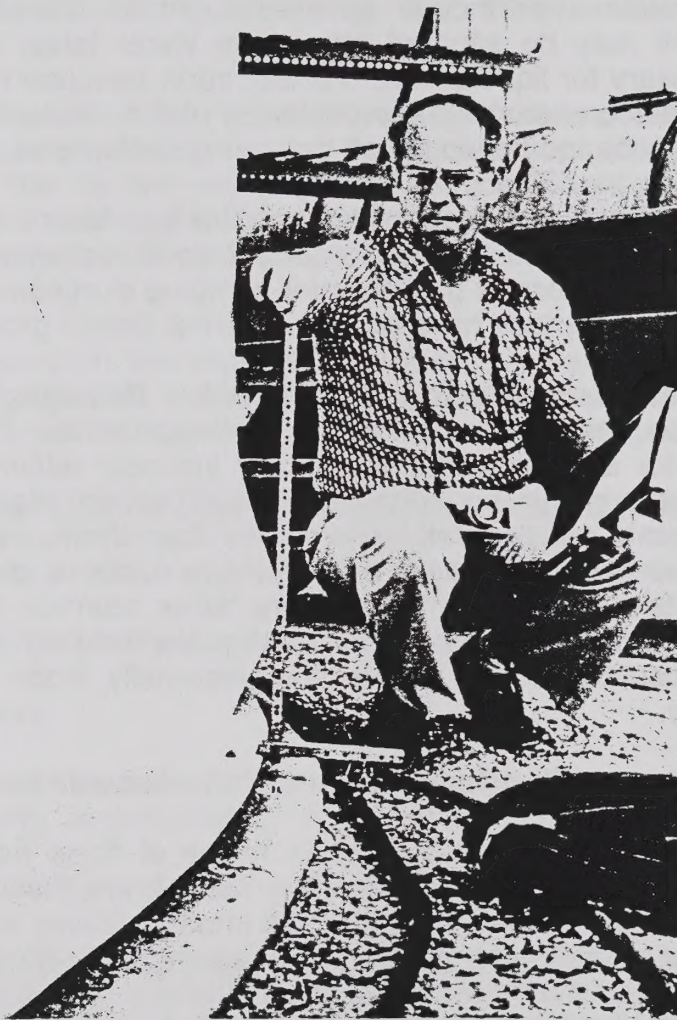
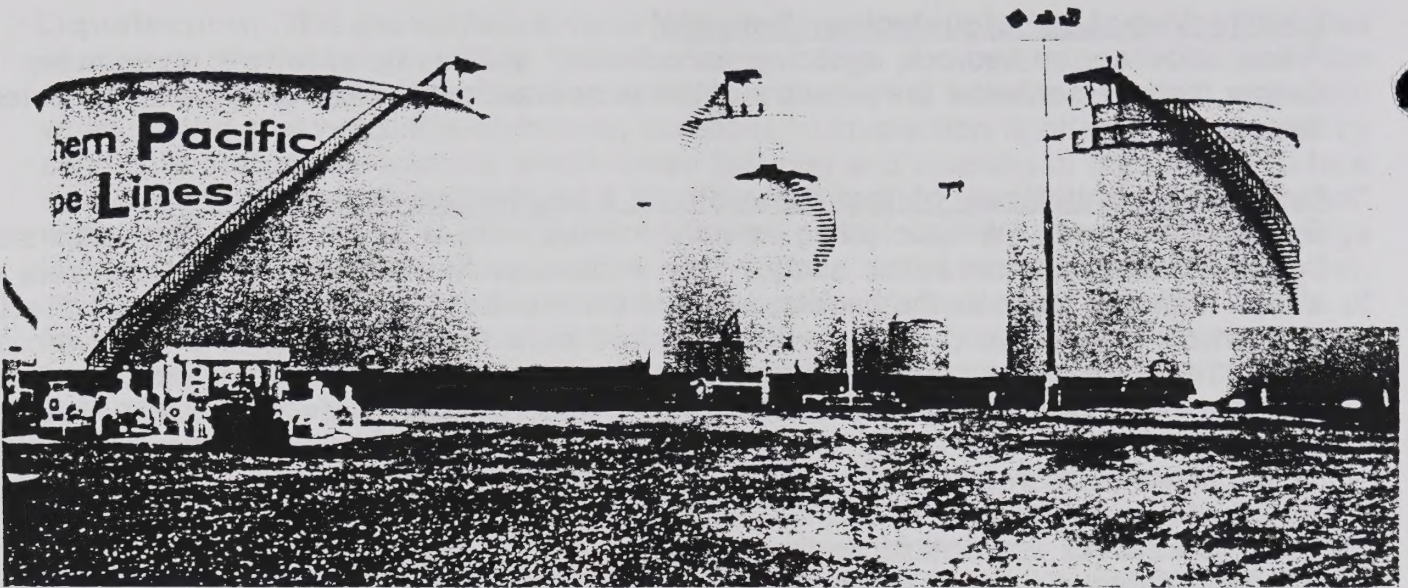


Figure 48. Depicts the failure of a storage tank by "elephants foot" deformation at the base of the tank as the result of an earthquake. This failure is typically caused by vertical motion during an earthquake. Similar ground motion effects can be anticipated within the region when surface rupture or earthquakes occur on faults in the vicinity of the Plan Area. From Sharp, et. al, 1982.

and tsunamis. Additionally, localized flooding from abundant liquefaction sand boils has occurred during recent strong earthquakes. This was evident in the 1989 Loma Prieta earthquake where a garage in San Francisco flooded.

3.3.1 Dam, Canal, Stormwater Drainage Channel Failure

Currently, there are no dams up gradient or upslope of the Coachella General Plan Area. The All American Canal, Whitewater River-Coachella Valley Storm Channel and other lined and unlined drainage channels within the CVWD's drainage and stormwater outlet system are located adjacent to or in the vicinity of the Coachella Valley segment of the San Andreas fault. Intense ground shaking or surface rupture from faulting in the vicinity of the above improvements could create a local flooding hazard. Accordingly, the potential for inundation from canal or storm water drainage channel failure is considered moderate to high in the eastern portion of the General Plan Area.

3.3.2 Seiche

A seiche is an oscillation of a water body in an enclosed or semi-enclosed basin (as are reservoirs behind dams or naturally occurring or man-made lakes), which can last from a few minutes to a few hours, with a height variation from a few inches to a few feet. A seiche may result from earthquakes or other causes (such as a landslide within the enclosed body of water). Considering that there are no current lakes or other significant impounded bodies of water within the Plan Area, the occurrence of a seiche is remote. However seiche potential should be considered for any planned lakes or reservoirs within the General Plan Area.

3.3.3 Tsunami

Earthquake induced ocean waves (tsunamis) generally occur as a result of seafloor displacement from thrust or normal faults. Locally, tsunamis may reach a height of 30 meters (100 feet) due to amplification by topography. Due to the Planning Areas great distance from the ocean, the potential for flooding due to tsunamis is considered to be remote.

3.3.4 Other Earthquake-Induced Flooding

Structural failure of water-retainment facilities is not limited to canals and storm drainage channels. Other structures capable of causing localized flooding upon failure are above ground or ground level storage tanks (Figure 48). These tanks can fail from internal pounding created by the rocking motion of the fluid inside the tank, or from failure of brittle or rigid pipe connections. Also, flooding from damage to "unbraced" fire suppressant sprinkler systems can render a building or facility unusable following a major earthquake. This condition closed the Olive View Hospital following the 1994 Northridge earthquake, even though there was no structural damage.

3.4 Seismically-Induced Slope Instability

Rockfalls and landslides are types of slope instability that can occur as a direct result of earthquake shaking. This type of slope instability is most likely to occur in areas having moderate to high landslide potential as noted on the Landslide Potential Map (Figure 37). Landslides and rockfalls can occur in these hillside areas during a strong earthquake.

Ground shaking can also cause slope failures in areas with over-steepened road cut slopes and building pad cut slopes within loose earth materials. Additionally, landslides during earthquakes are more likely in the wet season, and in areas of high ground water or saturated surficial soils. A generalized evaluation of seismically induced slope instability has been presented in Subsection 3.1.2.1.

3.5 Earthquake-Induced Fire Hazards and Hazardous Materials Incidents

The Coachella General Plan Area can have a variety of earthquake induced fire hazards and other threats. Earthquake-induced fire may occur in both wildland and urban settings. In the proposed Plan Area, the urban environment can be vulnerable to earthquake induced fires because of increase in potential development and the possibility of reduced fire fighting capability caused by damaged waterlines or the limitations of fire fighting equipment (e.g. high rise buildings).

The Plan Area is also vulnerable to unauthorized releases of hazardous materials, which can be fatal to hundreds of individuals near the release site. The 1987 Whittier Narrows earthquake enlightened many to the special risk of atmospheric releases of hazardous materials when a chlorine gas leak resulted in the threatened evacuation of a large number of residents. Additionally, ground shaking-caused plumbing leaks from underground fuel storage tanks or rupture of landfill liners could release hazardous substances to ground water supplies. These releases could remain undetected for several weeks or months after the causative earthquake.

3.5.1 Earthquake-Induced Fire Hazards

The principal causes of earthquake related urban fires include open flames, electrical malfunctions, gas leaks, and chemical spills. Severed, above and below ground natural gas and electrical (power) transmission lines could create a wildland or urban fire hazard. In an extremely severe earthquake, hundreds of fires could occur in street locations along the distribution system, especially if the lines have not been retrofitted or upgraded (Toppozada, et. al. 1988). This was evident in the 1994 Northridge earthquake when a spectacular fire was caused by a break in a residential street's natural gas transmission line. A large earthquake can damage natural gas (i.e. connections) and water facilities in residential, commercial and industrial buildings, including built-in safeguards, such as anchored gas water heaters, sprinkler systems and firewalls. Mobile homes can be the most vulnerable structures during strong ground motion, as evidenced in the 1994 Northridge earthquake where 76% of the earthquake related fires were caused when shifting structures sheared off utility lines where they came out of the ground (SSC, 1995). Additionally, transmission lines are subject to "burn down" caused by arcing of the lines as a result of swaying motion, and a disruption to water utilities can seriously hamper fire fighting capabilities.

3.5.2 Earthquake-Induced Hazardous Material Incidences

An earthquake of medium or strong intensity in the General Plan Area could result in hazardous materials releases, either by upsetting improperly stored materials through ground movement, or through urban fires setting off chemical fires in areas where quantities of hazardous chemicals are stored. In the event of a large earthquake, there is the possibility of hundreds of individuals being injured or killed from an extremely toxic hazardous materials release, before local officials could be mobilized and secure the release.

Industrial and manufacturing zones within the Plan Area may be the most vulnerable to hazardous material releases during an earthquake. Additionally, dry cleaners, science and research labs, gas stations, neighborhood grocery stores, and even individual homes may be potential sources of hazardous materials. Careless handling and storage of hazardous materials could result in dangerous liquid and gaseous releases during an earthquake. Landfill liners, and crude and refined oil pipeline ruptures could also produce local contamination. Potentially leaking landfills, such as the Coachella Landfill, could possibly be further damaged resulting in an increase in contamination. Waste water collection systems, such as those operated by local Sanitation Districts, also have the potential for contamination along the main collectors or any of the thousands of feet of collector lines (Davis, et. al, 1982; Topozada, et. al, 1988). Wholesale discharge of untreated or under-treated sewage could pose long term problems to the quality of local ground water resources and public health (LA County, 1990).

There were over 100 reported incidents involving hazardous materials related to the 1994 Northridge earthquake, including pipeline breaks, tank failures, falling containers, and transportation accidents. Among these accidents were fires possibly ignited by gas leaks or chemical reactions at major Universities and research labs, a derailed railroad car that leaked approximately 8,000 gallons of sulfuric acid, and a crude oil pipeline that released over 4,000 barrels of oil blocking access to a hospital prior as it flowed into a river (SSC, 1995).

3.6 Earthquake-Induced Disruption to Lifeline Systems

The analysis provided in the previous subsections indicates that the Coachella General Plan Area is susceptible to a wide range of hazards. Of these hazards, seismically related hazards are the most problematic in terms of the sudden potential for catastrophic losses. The damage pattern resulting from the recent 1994 Northridge earthquake confirms this susceptibility despite the continuing efforts to improve building codes and reinforce existing developments. All of the affected area's lifeline systems, including freeways, railroads, and communications, as well as, natural gas, water, power, and sewage disposal systems, suffered damage (SSC, 1995). Stresses on these essential lifeline systems, in turn, created interference with emergency personnel and critical facilities, such as hospitals, schools, and essential services and other dependent care buildings. Some critical facilities, especially older buildings, could also be impacted by damage resulting in loss of use. Additionally, critical facilities that lack braced sprinkler systems, or functioning back-up power generating systems could be impacted by loss of use following a severe quake.

Modified Mercalli seismic intensities of VIII or greater can have a significant impact on electrical power networks, and electrical substations in particular (Topozada, et. al., 1988). Those locations within the General Plan Area underlain by shallow water and alluvial sediments are the most susceptible to high intensities. In the Los Angeles area, utility companies estimate that major earthquakes on any fault may impose emergency power contingencies for up to three days (LA County, 1990). Emergency response communication is very important to post-disaster recovery situations. Communication is vulnerable not only to functional loss from electrical power supplies, but also from telephone saturation. This was evident in the 1994 Northridge earthquake where power outages and system overloads made communications difficult. Even cellular telephones were overloaded (SSC, 1995). Airports, freeways and State highways within the General Plan Area can expect to be

impacted with moderate to high seismic activity or surface rupture on the nearby Coachella Valley segment of the San Andreas fault. A ripple affect would impact critical facilities immediately after and for a longer period of time following a causative earthquake.

In summary, a great earthquake (M7.7-8.3) on the southern San Andreas fault would cause regional disruption of the infrastructure, so that the Coachella General Plan Area must be prepared to "survive" with little or no outside help for days following the causative event. The effects on the regional economy are poorly known, but could be substantial requiring decades for full recovery.

Section 4

Management of Development Impacts and Mitigation Measures

1. The first part of the report is a general introduction to the subject of the study.

2. The second part of the report is a detailed description of the methods used in the study.

3. The third part of the report is a discussion of the results of the study.

Conclusion

Summary of the findings of the study.

Section 4.0

Management of Development Impacts and Mitigation Measures

4.0 Geology, Soils and Seismicity

Introduction. The geologic history of the Coachella Valley area is important to understand and consider for planning purposes because there are several direct cause-and-effect relationships between the geologic formation of the region and the resulting seismic and geotechnical hazards. These hazards can be best evaluated by understanding how and why they formed. The geologic forces that produced the mountains and valleys that define the Coachella General Plan Area also produced features that pose hazards to the people living in this area. Many of these hazards can be specifically addressed and evaluated in terms of their impact on future planning in the Coachella General Plan Area. Proper site investigation, hazard conscious project design, and hazard mitigation engineering compose prudent safety planning.

Setting. The geology of the Coachella General Plan Area forms an extremely important part of the physical development of the region, its unique attractions, and its specific hazards. The Plan Area lies within the Coachella Valley, which is the lowland area lying west of the Indio and Mecca Hills and Orocopia Mountains and east of the Santa Rosa Mountains of the Peninsular Ranges. This valley is actually very young (geologic time scale) and is a direct product of the extensional tectonics related to the mid-Tertiary Salton Sea-Trough detachment fault, the Orocopia detachment system, and the more modern San Andreas fault system. Offset on the two detachment faults produced the valley which progressively grew as the detachment faults moved. During this offset, sediments were dumped from the topographic highs (mountains) to fill the lows (valleys) and developed geologic units in such areas as the Indio and Mecca Hills, which are now exposed due to movement along the San Andreas fault system. Soils of different ages and compositions have developed on these sedimentary units, and on the younger alluvial sediments filling the valley floor. These soils form a thin layer over the underlying geology and pose certain hazards themselves, such as erosion and slope instability. Also, the nature and topographic position of the geology, soils and groundwater contribute to the presence of certain geologic and geotechnical hazards, some of which can be mitigated through appropriate engineering studies and practices, others that probably would be best avoided by maintaining the area as open space.

Several active, potentially active and non-active faults either transect or are in close proximity to the General Plan Area. Active faults, as defined by the California Division of Mines and Geology (CDMG), for inclusion in Alquist-Priolo Earthquake fault hazard zones that traverse the Plan Area include the San Andreas, Painted Canyon, Skeleton Canyon, Indio Hills, and Coachella Fan fault zones. Active/Potentially active faults that transect the General Plan Area include: 1) the southeasterly fault segments or extensions of the Coachella Fan fault zone and Indio Hills fault, 2) and the northwesterly extensions of the Painted Canyon and Skeleton Canyon fault zones. The above fault zone extensions are considered segments of the San Andreas fault zone and are not presently zoned for Alquist-Priolo Earthquake fault zone or Riverside County Fault zone studies. However, based on currently available literature, they should be considered active, or at a minimum, potentially active. The Santa Rosa Mountain detachment fault underlies the General Plan Area at considerable depth. This fault is considered part of an older fault system and is not considered to be active or potentially active by the CDMG.

The San Andreas and other fault zones within close proximity to the Plan Area are seismically active and are capable of generating strong ground shaking throughout the Coachella Valley. Maximum horizontal ground accelerations from 30 year probable earthquakes on these faults are anticipated to substantially exceed 0.4g, which is the current maximum Uniform Building Code design value. For a complete discussion of existing geologic, soils and seismic conditions, consult Section 2.0, The Geologic and Seismic Environment of Coachella.

For ease of clarification, the following subsections provide a summary of conclusions and possible mitigation measures as applied to the potential impacts presented in Section 3.0 of this Seismic and Geologic Technical Appendix. For cross referencing purposes, the subsection numbers in Section 3.0 will parallel the subsections numbers in this Section (e.g., mitigation of Geologic Hazards or potential impacts presented in Subsection 3.1 will be addressed in Subsection 4.1).

4.1 Principal Geotechnical Impacts, Constraints and Mitigating Measures

Geologic and geotechnical hazards which may limit development opportunities in the Plan Area include: Slope instability, such as natural and man-made landslides, rockfall, mud/debris flow and soil creep; subsidence (groundwater withdrawal); collapsible soil, such as water induced ground collapse; expansive soils; and percolation potential/effluent disposal.

4.1.1 Erosion Impacts and Mitigating Measures.

Erosion Conclusions - Summary of Impacts. Those portions of the Coachella General Plan Area that have slopes steeper than 15 percent are subject to concentrated water runoff "type" erosion of both soil and rock. Most surficial soils within the Plan Area are subject to wind erosion from the prevailing northwesterly winds as shown on Figure 36.

Mitigating Measures. All grading and landform modifications in the Plan Area should be carried out under guidelines set forth in Chapter 70 of the Uniform Building Code (as a minimum), state-of-the-practice design/construction standards, and/or guidelines established by the City of Coachella, County or other responsible regulatory agency as appropriate. The Riverside County Planning Department's Technical Guidelines for Review of Geotechnical and Geologic Reports (1992) should be utilized as the primary support guidelines for grading permit applications and grading compaction reports in the Plan Area. All graded slopes should be designed and constructed to be grossly and surficially stable, as per the initial guidelines to be established in the recommended geotechnical and engineering geologic investigations as indicated in following subsections. Additionally, preparation of Erosion Control Plans as per the guidelines established by the County of Riverside, Office of Building and Safety (Guidelines for Erosion and Sediment Control Plans), or other responsible regulatory agency should be required prior to development activities within the Plan Area.

Modification to the existing surface water flow patterns within the affected portions of Whitewater River/Coachella Valley Storm Channel and its drainage and stormwater outlet system tributaries resulting from construction activities within the Planning Area should be addressed and evaluated by each project proponent design engineer. Surface water runoff should be controlled via water control structures or positive drainage devices to divert sheet flow runoff away from areas which have been stripped of natural vegetation. Such structures

or devices include sediment filters, settling ponds, waterbars, culverts with energy dissipaters, concrete lined ditches, earth berms and bench terraces. Modifications with the above devices should be expected to result in improved erosion and flood control within the Plan Area.

Cleared areas and cut and fill slopes should be provided with temporary and permanent erosion control measures as specified by each project proponent design engineer, or prepared Erosion Control Plan based on County of Riverside or City of Coachella requirements until drought resistant landscaping stabilizes. Additionally, stripped areas may be covered with artificial substances such as Mirafi Miramat 1800, 2400, or equivalent, to reduce surface erosion while permanent landscaping solutions become well established.

Those General Plan Areas subject to potential blown sand hazards can be mitigated, or the potential hazard reduced, through landscaping, windbreaks, and ground cover. Additional development will contribute to the reduction of the amount of blown sand by eliminating source areas of sediment.

4.1.2 Landslide Impacts and Mitigating Measures.

Landslide Conclusions - Summary of Impacts. In general, no landslides over five acres in size have been indicated in the literature or aerial photos reviewed for the Plan Area. It is anticipated, however, that a majority of the potential landslides that could occur in the Plan Area would include soil slumps and rock falls caused by earthquake activity, debris/mud flows caused by rainfall or concentrated runoff, or man and development induced landslides. Most potential slope instability concerns are located within the eastern hillside portion of the Plan Area as depicted on Figure 37. Other summary items or slope instability related conclusions are as follows:

- Tens of billions of dollars in damage and thousands of deaths have been attributed to small to extraordinary earthquake-induced landslides in the 20th century on a worldwide basis.
- The 1971 San Fernando Earthquake, 1994 Northridge Earthquake and the 1992 Big Bear Earthquake triggered hundreds of slumps, debris slides, and rockfalls in Los Angeles and San Bernardino Counties. Extremely large slides have been reactivated by the 1994 Northridge Earthquake in the Simi Valley area.
- Small surficial slides may have adverse consequences on emergency response for hillside areas given the expected ubiquity of road blockages triggered by widespread landsliding.

Mitigating Measures. A summary of mitigating measures for slope instability concerns is addressed in the subsection entitled "Geotechnical Mitigating Measures" presented below. Additional mitigating measures are as follows.

- Regular review of existing building code regulations is necessary to improve hillside safety and prevent future economic losses to public and private property.
- Proper slope design should include the worst-case effects of fluctuating or perched ground water levels.
- Fill slopes are most stable if constructed at 2:1. To achieve the same margin of safety for slopes steeper than 2:1, structural reinforcement should be considered.

- Adequate building setbacks and structural mitigation provide the most effective strategy of ensuring safety and preventing losses from debris flows and earthquake-induced slope failures.
- Construction of structural reinforcement along road cuts adjacent to primary and secondary evacuation routes provides the greatest margin of safety by ensuring access and regress for emergency response.
- The cooperation of private property owners is essential in a comprehensive hillside safety program. Homeowners should be provided with easily accessible geologic and other appropriate information, and incentives or disincentives to achieve slope stability.
- A comprehensive hillside program must include provisions for post-development problems, including dewatering contingency plans, regulations designed to reduce all sources of artificial ground water recharge, and regulations for subsequent development on adjacent properties.
- Geologic and geomorphic field mapping is a necessary element of a debris flow susceptibility mapping program. Other slope stability maps are only feasible if adequate geologic information, such as rock type, geologic structure, and topography are mapped at scales of at least 1:24,000.
- A proactive program of public education explaining the financial benefits of homeowner slope maintenance, the consequences for slope problems, related to their activities on their property, and the need for full homeowner cooperation is a necessary component of any hillside management plan.
- Many counties and cities in California have developed standard guidelines for hillside development. Foremost is the requirement for geologic investigations in all hillside areas. Private consultants may, at their discretion or unless directed otherwise, adopt such criteria in fulfilling hillside development regulations. Leighton (1976) estimated that 95 to 99 percent of all proposed development in any hillside area can be safely designed if proper investigation and grading practices are followed.
- Downhole logging, trenching, sampling, and lab analyses are fundamental aspects of any geotechnical investigation. During this stage of development, the detailed investigation may reveal numerous slope stability problems not evident from earlier phases of the investigation. This initial design phase and any modifications proven necessary during the actual grading operation helps ensure the future integrity of the building pad. Based on detailed subsurface data, the geotechnical consultant prepares site plans and cross-sections, indicating the distribution of alluvium, artificial fill, bedrock types, potentially problematic geologic structures, and existing shallow hydrogeologic (perched water) conditions.

4.1.3 Subsidence Impacts and Mitigating Measures.

Subsidence Conclusions - Summary of Impacts. Certain portions of the Coachella Plan Area may be prone to tectonic warping and subsidence. Although subsidence due to withdrawal of underground fluids has not been documented within the General Plan Area, it should be anticipated based on similarity of the Coachella Valley agricultural use with other

areas where regional subsidence has occurred. Hydrocompaction is a common cause of subsidence and has resulted in extensive fissuring of the ground surface in many agricultural areas of the Southwest (Holzer and Clark, 1981). Tectonic elevation changes or settlement produced during extremely large earthquakes are presented in later subsections.

Mitigating Measures. Depending on the depth and mechanical properties of the lower aquifer in the Thermal subarea and overlying sediment, alluvial areas can subside if ground water resources are not managed properly. Studies and monitoring programs can be implemented to evaluate subsidence concerns from groundwater withdrawal. If groundwater extraction is found to be resulting in subsidence, prudent subsidence management would require cooperation between all agencies (i.e. CVWD) and individuals extracting water. Mitigation measures could include construction of groundwater recharge basins or wells, or use of imported water.

- Prudent ground water management practices should be followed in the Coachella area. Future objectives in areas possibly sensitive to subsidence include:

1. Region-wide survey leveling for vertical changes in elevation and mapping of ground fissures;
2. Synthesis of well data and gravity, seismic, and other geophysical methods to characterize the underlying aquifer; and
3. Cooperation of involved ground water jurisdictions to prevent or mitigate subsidence in the Coachella Valley alluvial basin.

4.1.4 Collapsible Soil Impacts and Mitigating Measures.

Collapsible Soil Conclusions - Summary of Impacts. Collapsible soils are primarily associated with recently deposited alluvium in arid and semi-arid environments where the addition of irrigation, flood or sewage effluent water induces failure. Within the General Plan Area, collapsible soils are most commonly associated with wind laid sands and silts, alluvial fan materials rimming the valley, and mudflow sediments deposited during flash floods. Collapsing soils can cause differential settlement to occur in building foundations and other infrastructure improvements.

Mitigating Measures. A summary of mitigating measures for collapsing soil concerns is addressed in the subsection entitled "Geotechnical Mitigating Measures" presented below. Additional mitigating measures are as follows.

- Increased awareness of collapsible soils by public officials, consultants, developers, future homeowners, and contractors will encourage proper investigation, foundation design, and the use of drought resistant landscaping to mitigate potential problems before they occur.

4.1.5 Expansive Soil Impacts and Mitigating Measures.

Expansive Soil Conclusions - Summary of Impacts. Expansive soils swell when they become wet and shrink when they dry out. Consequences of this expansion and contraction are cracked building foundations, ruptured utilities, differing elevations of adjacent sidewalk and driveway sections, and sometimes, severe structural distress of the buildings themselves. Those portions of the General Plan Area that have expansive soils concerns as presented in Soil Conservation Service Maps are depicted on Figure 41.

Mitigating Measures. A summary of mitigating measures for expansive soil concerns is addressed in the subsection entitled "Geotechnical Mitigating Measures" presented below. Additional mitigating measures are as follows.

- Expansive soils are generally located in the southern portion of the Plan Area. Proper site investigation, soil testing, foundation design, and enforcement of construction grading practices, are the most efficient planning tools for locating, assessing the severity of, and mitigating expansive soils in a proposed development.

4.1.6 Percolation Potential/Effluent Disposal Impacts and Mitigating Measures.

Percolation Potential/Effluent Disposal Conclusions - Summary of Impacts.

Those hillside sections of the Planning Area where on-site sewage effluent disposal is necessary for development may create impacts to down stream water quality and initiate or contribute to slope instability. Mecca Hills (badlands) soils are considered to have a moderate to high impact to slope instability and groundwater quality from effluent disposal.

Mitigating Measures. A summary of mitigating measures for Percolation Potential/Effluent Disposal concerns is addressed in the following subsection entitled "Geotechnical Mitigating Measures" presented below.

Geotechnical Mitigating Measures. A geotechnical investigation performed by both a Professional Soils/Geotechnical Engineer and a Certified Engineering Geologist of the specific improvement locations, including new construction and exterior building expansions for multi-story additions or lateral expansions, within the Plan Area is considered necessary to evaluate the nature of site materials, develop appropriate grading recommendations, and assist with development of design parameters. At a minimum, these investigations should follow the standards presented in the Riverside County Technical Guidelines for Review of Geotechnical and Geologic Reports (Revised 1992). Geotechnical and/or engineering geologic investigations may not be recommended in those project areas where the surface topography is not anticipated to be altered, such as open space areas. These investigations can identify erodible, expansive and collapsible soils, existing or potential landslides, areas with unsuitable percolation characteristics for placement of onsite sewage disposal systems, large scale subsidence, or other geotechnical concerns and make recommendations for mitigating any potential adverse affects. As an example, geotechnical recommendations for selective grading or overexcavation and recompaction is anticipated to mitigate the potential for soil collapse, hydroconsolidation, or expansive soil concerns.

Potentially hazardous slope failures in the Plan Area can usually be avoided by utilization of a combination of pre-grade and in-grading or construction geologic inspections, mapping, and analysis. Additionally, each project proponent should include engineering geologic field mapping during grading activities in order to develop an as-built geologic map. Any remedial measures applied should also be documented for their compliance with the project geotechnical and engineering geologic consultant's recommendations.

Unanticipated slope failures, such as those encountered during construction or development activities, can be mitigated by several slope stabilization techniques. These stabilization methods can include slope flattening, retaining or reinforced walls, rock slope buttresses, and slope grouting.

Engineering geologic, hydrogeologic or geotechnical investigations can identify suitable effluent disposal areas that would not have potentially adverse affects on local groundwater or slope stability.

4.2 Principal Faulting, Seismicity Impacts and Constraints

The Coachella General Plan Area contains several hundred acres of lands situated within Alquist-Priolo Zones. Many of the seismic and faulting hazards which exist throughout the Plan Area are a result of potential earthquake activity and include: ground rupture, strong ground motion or shaking, liquefaction, secondary seismic hazards (i.e. differential compaction, lateral spreading and settlement), rockfall and landsliding, and earthquake induced flooding. For a complete discussion of each of the above faulting and seismic related hazards, consult Section 3.2, Faulting and Seismic Hazards.

4.2.1 Fault Rupture Hazard Impacts and Mitigating Measures.

Fault Rupture Hazard Conclusions - Summary of Impacts. Several APEFZA defined active and active/potentially active faults occur in the northeastern portion of the General Plan Area. Active faults defined for the Coachella General Plan Area are those with evidence of ground rupture within 10,000 year old or less sediments. Active faults include the San Andreas, Painted Canyon, Skeleton Canyon, Indio Hills, and Coachella Fan fault zones. Active/Potentially active faults that transect the Plan Area include: 1) the southeasterly fault segments or extensions of the Coachella Fan fault zone and Indio Hills fault, 2) and the northwesterly extensions of the Painted Canyon and Skeleton Canyon fault zones. The above fault zone extensions are considered segments of the San Andreas fault zone and are not presently zoned for Alquist-Priolo Earthquake fault zone or Riverside County Fault Zone studies. However, based on current studies, they should be considered active, or at a minimum, potentially active. The Santa Rosa Mountain detachment fault underlies the General Plan Area at considerable depth. This fault is part of an older fault system and is not considered to be active or potentially active by CDMG criteria, as modified. If ground rupture does occur along the traces of identified active and/or active/potentially active faults that traverse the Plan Area, damage to overlying or immediately adjacent improvements cannot be avoided. Other fault rupture hazard conclusions are as follows:

- Public Safety will be increased by planning mitigation measures around all active and potentially active faults.
- Offset and warped Holocene stratigraphy and youthful geomorphology are evidence of active faulting and high-risk for potential future surface fault rupture or ground deformation in the easterly portion of the Plan Area.
- Potentially active faults (10,000 to 750,000 years) pose mainly a ground shaking hazard to normal development, but may be considered high-risk when siting critical facilities.
- Each active fault poses unique problems to subsurface investigation depending on the geologic and geomorphic environment and must be considered on a case by case basis. With the exception of the Santa Rosa Mountain detachment fault, all fault zones in the Plan Area should be considered active, or at a minimum potentially active, unless site-specific, geotechnical investigation suggest otherwise.

Decision makers need to consider the sensitivity and unacceptable risk for siting critical facilities on potentially active faults.

Mitigation Measures. To mitigate the effects of potential surface displacement along faults, a structural setback zone for human occupancy developments from these features would be necessary. Setting back a building from an active fault is a useful component of a seismic safety program. The setback distance can be based on the type of construction proposed. As an example, facilities that involve chemical, or volatile and explosive materials may need extraordinary setback distances away from an active fault. Criteria for such setback decisions can be predetermined by the City of Coachella or the County of Riverside. Recommended fault setbacks include 50 feet for all structures proposed for human occupancy, and 150 feet or further setbacks for critical facilities.

Geologic and geotechnical fault studies would be a requirement, and involve exploratory trenching and age dating to evaluate "activity" according to CDMG criteria, as modified herein, and the County of Riverside standards within 500 feet of each fault depicted in Figure 42. Riverside County standards includes the supervision of fault trench investigations by the County geologist. Also, to ensure that site conditions are recorded as found, Environmental Report Sheets identifying existing geotechnical reports within the Plan Area should be kept on file with the Planning Department and logged into records of the Building and Safety Department.

Additionally, existing or planned roadways and canals that traverse active faults can be widened, supported or retrofitted, and subsurface improvements (i.e. utilities and connections) can be designed to withstand potential ground rupture or deformation.

4.2.2 Primary Seismic Hazard Impacts and Mitigating Measures.

Primary seismic hazards are generally related to strong ground motion and acceleration.

4.2.2.1 Strong Ground Motion Hazard Conclusions - Summary of Impacts. In the event of a significant earthquake on the nearby Coachella Valley or San Bernardino Valley segment of the San Andreas fault or Anza segment of the San Jacinto fault, residents throughout the General Plan Area would experience the effects of strong ground shaking. Based on its past earthquake history, the Coachella Valley segment of the San Andreas fault has a $22 \pm 12\%$ (high) probability of suffering a large earthquake of $M \geq 7$ during the next three decades (Working Group, 1995). Additionally, the 30 year probability of a M6.9 earthquake occurring on the nearby San Jacinto fault zone is calculated as 37 percent (Working group, 1995 and Toppozada, 1993) and the 30 year probability for a M7.3 earthquake occurring on the San Bernardino Mountains segment of the San Andreas fault is 28 percent (Working group, 1995 and Toppozada, 1993). Although estimations of probable earthquakes are important for planning purposes, it should be noted that the maximum credible earthquake for the southern California segment of the San Andreas fault is calculated as M8.3 (Davis, et. al. 1982).

Strong ground motion is anticipated to exceed the UBC design value of 0.4g. Per currently accepted seismic design criteria, the causative faults in the vicinity of the Plan Area are the Anza segment of the San Jacinto fault, Elsinore fault and Coachella Valley segment of the San Andreas fault. These faults are capable of generating an earthquake with an estimated design event exceeding magnitude M7.0 during the economic life span of the improvements

in the Plan Area. Effective Peak Ground (bedrock) Accelerations (EPGA) in excess of 0.7g or more can be anticipated for a maximum 100-year probable earthquake event on the San Andreas or San Jacinto faults. This ground motion value is based on the preliminary Seismic Hazard Analysis performed for the General Plan Area, as shown on Tables 6 and 7, and is not be used in lieu of site specific analysis. Other strong ground motion hazard conclusions are as follows:

- The type and depth of fault rupture, the basin geometry and topography, the character of subsurface geology, and the local near site conditions that might result in site amplification are controlling parameters affecting ground motion.
- The level of ground shaking at the location of a building or lifeline is greatest in the near field, except where the local alluvial/soil conditions cause amplification of ground motion; for example, the severity of the 1985 Mexico City Earthquake was caused by ground amplification.
- Site amplification studies in the General Plan Area are necessary in constructing a building or structure, in that seismic design parameters are precisely defined and quantified.
- Ground acceleration derived from attenuation relationships should not be used for seismic design or predictive ground motion mapping. Site amplification and frequency content are necessary components of a predictive ground motion or earthquake damage model.
- Because the usefulness of seismic intensity mapping relies on new damage information from earthquakes, an effort should be made to make predictive damage descriptions more representative of the construction and architecture common to the Coachella General Plan Area.
- A composite intensity map similar to Figure 33, in conjunction with potentially hazardous building inventories may facilitate rehabilitation planning and promote efficient prioritization of areas where programs should be targeted.

Mitigation Measures. To mitigate the potential effects of anticipated ground shaking due to local or distant earthquakes in the General Plan Area, proper design criteria recognizing the potential seismicity of the area should be utilized by planners as well as each project proponent design engineer.

Uniform Building Code seismic design requirements are based upon criteria limited to fulfilling life safety concepts. Structures designed in accordance with the provisions of the Uniform Building Code should be able to resist major earthquakes of the severity anticipated at the subject site without collapse, although structural damage could occur (Structural Engineers Association of California, 1988). The reference also indicates that an effective peak ground acceleration (EPGA) of 0.40g ($Z = 0.40$) for Seismic Zone 4 has been assumed for derivation of seismic formulas presented in Chapter 23 of the Uniform Building Code.

Based on Uniform Building Code acceptance of some structural damage without collapse, development within the Plan Area should be designed in accordance with the seismic formulas and requirements presented in the current version of the Uniform Building Code. However, consideration should be given to anticipated code changes based on new ground motion information gained from the 1994 Northridge and other recent earthquakes, such as

higher than calculated ground accelerations that caused substantial infrastructure damage. In particular, higher levels of ground accelerations will be used for design in the near field for active faults.

In the event of a significant earthquake on the nearby Elsinore, San Jacinto or San Andreas faults, residents throughout the General Plan Area would experience the effects of strong ground shaking. To protect against the impacts of ground shaking, General Plan policies are recommended to promote a building inspection program to identify potentially hazardous buildings including: unreinforced masonry URM buildings; certain tilt-up concrete buildings; nonductile concrete-frame buildings; buildings that have long spans, irregular shapes, or weak "soft-stories; dilapidated buildings or those weakened through modification; mobile homes not tied to foundations; non-structural hazards (interior and exterior); and buildings located in geologically hazardous areas (faulting, landsliding, or soil liquefaction). Additional building inspection program recommendations include systematic upgrading of seismically unsafe buildings, and development of a City-based public awareness/earthquake preparedness program coordinated with the County geologic educational program.

Based on ground motion information collected from southern California earthquakes within the last five years, and in anticipation of seismic design code changes, consideration should be given for additional General Plan Policies to: 1) require submittal of geologic information by certified engineering geologists and seismic information by qualified registered geologists and geophysicists, for any discretionary project or development proposal in an earthquake-hazardous area. The reports are to be prepared in accordance with State Guidelines or stricter standards for any discretionary project or development proposal subject to earthquake induced hazards, and 2) encourage updating of the Uniform Building Code (UBC) to incorporate the most current seismic design standards and hazard reduction measures from the Applied Technology Council (ATC), the Structural Engineers Association of California (SEAOC) and the Earthquake Engineering Research Institute (EERI).

4.2.3 Secondary Seismic Hazard Impacts and Mitigating Measures.

Secondary seismic hazards, such as those associated with severe ground shaking during an earthquake include liquefaction and earthquake induced ground settlement.

4.2.3.1 Liquefaction Hazard Conclusions - Summary of Impacts. Liquefaction hazards include large areas of ground settlement, local differential settlement and lateral spreading. Figure 47 represents Generalized Liquefaction Potential in the Plan Area based on depth to shallow or perched groundwater and location of alluvial sediments. Based on site specific liquefaction studies by consultants, some isolated areas were found to have no liquefaction susceptibility within those areas of the Generalized Liquefaction Map identified as liquefiable. Other secondary seismic hazard conclusions are as follows:

- Information from private consultants, and local, State and Federal agencies requiring geotechnical, environmental, or hazardous waste monitoring reports should be utilized to evaluate the hydrology and transience of shallow ground water in areas identified as liquefiable on Figure 47, and to establish the presence of perched or high groundwater in other portions in the General Plan Area not indicated as being liquefiable or potentially liquefiable.

- The National Research Council (1985) acknowledges that significant improvements are necessary for protection of critical facilities from the liquefaction threat. Localized groundwater monitoring programs in susceptible areas occupied by critical facilities should be considered so that adequate precautionary measures can be readied during periods of high groundwater conditions.
- Dewatering, treatment of soil materials, and an evaluation of existing County regulations concerning the effectiveness of existing regulations for liquefaction resistant foundations and frames should be considered and possibly applied to liquefiable areas shown on Figure 47.
- The potential for lateral spreading should be emphasized where liquefiable areas coincide with slopes measuring between .5 and five degrees, or where free faces exist at the boundaries of flat lying areas. Structural setbacks from unreinforced "free face" areas should be considered as a mitigation measure from lateral spreading type failures.
- Periodic refinement of Figure 47 with any additional information acquired during the acquisition of standard penetrometer data (ASTM D1586 as recommended by Seed, et. al., 1985) with perched and shallow groundwater information should be attempted so that the next generation of liquefaction potential maps can be built upon the existing data base.
- An analysis of the benefits or disadvantages of shallow groundwater aquifer recharge with respect to the potential increase in liquefaction risk should be considered in determining long-term groundwater policy.

Mitigation. Mitigation of liquefaction potential beneath proposed improvements can be accomplished by densification of soil materials, replacement of existing soil with nonliquefiable material, emplacing permeable columns of gravel to furnish a release mechanism for causative buildup in water pressure, or by lowering the water table through dewatering wells. Deep pilings are also an option, if anchored into firm subsurface material and laterally braced for horizontal loads. The effects of potential lateral spreading can be mitigated through use of slope reinforcement; such as retaining walls.

Mitigation of potential liquefaction constraints should include both an engineering geologic and geotechnical subsurface investigation performed by a certified engineering geologist and professional soil/geotechnical engineer similar to investigations recommended in the geologic hazards mitigation subsection. Based on the existing data, geotechnical site investigations should require, at a minimum, standard penetration testing, for liquefaction susceptibility in liquefiable areas depicted on Figure 47 to at least a depth of 30 feet, with at least one boring extending to a depth of 50 feet.

Requirements for critical facilities or potentially hazardous buildings vulnerable to foundation or structural damage from liquefaction should be more conservative. Geotechnical investigations up to a depth of 50 feet may be appropriate in these areas.

4.2.3.2 Earthquake-Induced Ground Settlement Conclusions - Summary of Impacts. Seismic Settlement. During very large earthquakes, it is possible for subsidence or seismically induced settlement to occur in loose granular soils in the flat or gently sloped portions of the Plan Area as a result of intense ground shaking. Seismic induced settlement may total many feet. Differential settlement is a form of seismic induced settlement

and occurs along areas where the depth to bedrock varies abruptly, such as along the edges of alluvial basins, west of the Mecca Hills. Existing data is insufficient to identify areas of significant seismically induced settlement potential in the Coachella Valley, although it is anticipated that such areas would be expected to correspond within the areas of shallow groundwater, or areas of liquefaction potential.

Mitigation. Geotechnical investigations in alluvial areas, similar to those described in the above mitigation subsections, should be required to address the potential for earthquake-induced settlement and/or differential dynamic settlement.

4.3 Earthquake-Induced Flood and Inundation Hazard Impacts and Mitigating Measures.

Earthquake-Induced Flood and Inundation Hazard Conclusions - Summary of Impacts. Earthquake induced flooding most commonly occurs with dam, levee, pipeline, canal or aqueduct failures, and with seiches and tsunamis. Above ground fluid storage tanks can also present a localized flood hazard from seismic activity. There are no dams, large bodies of water, or oceans upslope of the General Plan Area. However, the All American Canal, Whitewater River-Coachella Valley Storm Channel and other lined and unlined drainage channels within the CVWD's drainage and stormwater outlet system are located adjacent to or in the vicinity of the Coachella Valley segment of the San Andreas fault. Localized seismically-induced flood hazards also include liquefaction-sand boils and severed sprinkler system within buildings. Intense ground shaking or surface rupture from faulting in the vicinity of the above improvements could create a local flooding hazard.

Mitigation. Seismically induced flooding within the lined and unlined channels and drainages of the CVWD's stormwater outlet system and the All American Canal can be mitigated by construction of secondary containment systems such as debris basins, or emergency shut off valves. Above ground tanks can be anchored laterally with respect to anticipated ground motions. Above ground tanks can also be provided with flexible connections to inlet and outlet pipes. Sprinkler system utilized for fire suppressant activities can be anchored or braced for support. Projects proposed for expansion of existing development or construction of new facilities, especially critical facilities, within areas subject to seismically induced flooding or other high-risk inundation areas (i.e. adjacent to canals) should be reviewed with respect to ground failure potential.

4.4 Earthquake-Induced Slope Stability Hazard Impacts and Mitigating Measures.

Earthquake-Induced Slope Stability Hazard Conclusions - Summary of Impacts. Rockfalls, landslides and boulder rollout are types of slope instability that can occur as a direct result of earthquake shaking. This type of slope instability is most likely to occur in areas having moderate to high landslide potential as noted on the Landslide Potential Map (Figure 37), hillsides areas or cut slope.

Mitigation. A summary of mitigating measures for slope instability concerns, which includes earthquake-induced landslides is addressed in the subsection entitled "Geotechnical Mitigating Measures" presented above.

4.5 Earthquake-Induced Fire Hazards and Hazardous Materials Incidents Impacts and Mitigating Measures. In the proposed Plan Area, the urban environment can be vulnerable to earthquake induced fires because of an increase in potential development and the possibility of reduced fire fighting capability caused by damaged waterlines or the limitations of fire fighting equipment. The Plan Area is also vulnerable to unauthorized releases of hazardous materials, which can be fatal or produce long term health impacts to those individuals near the release site.

4.5.1 Earthquake-Induced Fire Hazard Conclusions - Summary of Impacts. The Riverside County Fire Department is responsible for preventing and suppressing fires in those portions of the General Plan Area that contract for fire services. Other State and Federal fire agencies, such as the California Division of Forestry, can also provide fire suppression services within the Plan Area. The principal causes of earthquake related urban fires include open flames, electrical malfunctions, gas leaks, and chemical spills. Severed, above and below ground natural gas and electrical (power) transmission lines could create a wildland or urban fire hazard. A large earthquake can damage natural gas (i.e. connections) and water facilities in residential, commercial and industrial buildings, including built-in safeguards, such as anchored gas water heaters, sprinkler systems and firewalls. Additionally, transmission lines are subject to "burn down" caused by arcing of the lines as a result of swaying motion, and a disruption to water utilities can seriously affect fire fighting capabilities. Other conclusions include:

- The density and type of development should allow for provisions that establish water-fire flow requirements, minimum road widths and clearance standards around structures based on earthquake hazard considerations.

Mitigation. Current fire or water codes can be modified in those portions of the Plan Area that are susceptible to potential liquefaction, earthquake-induced slope movement or fault rupture from earthquakes to include additional safety measures, such as redundant water pipelines, flexible polyethylene pipeline materials, or above ground pipelines easily accessible for emergency repair.

Building setbacks along lot lines can be used as fire breaks or evacuation routes, and peak load water requirements can be increased in those areas with potential earthquake-induced ground failure. Development in hillside areas susceptible to geologic hazards should require multiple access emergency response capability.

Maintain, strengthen and require the review of proposed new construction and modifications to existing facilities with regards to seismically induced fires, such as those caused by electrical malfunctions, gas leaks, and chemical spills. Upgrade City fire prevention standards in areas of seismically induced fires, and wildland and urban fire hazard areas. Strengthen the City's water storage facilities and capabilities with regards to those Plan Areas susceptible to seismically-induced ground failure.

4.5.2 Earthquake-Induced Hazardous Materials Incidents Conclusions - Summary of Impacts. A moderate earthquake in the General Plan Area could result in hazardous materials releases, either by upsetting improperly stored materials through ground movement, chemical fires in areas where quantities of chemicals are stored or subsurface releases from plumbing or pipeline leaks. Industrial and manufacturing zones, as well as, dry cleaners, science and research labs, gas stations, neighborhood grocery stores,

and even individual homes may be potential sources of hazardous materials. Potentially leaking landfills, such as the Coachella Landfill, could possibly be further damaged resulting in an increase in contamination. Earthquake-induced ground failures could impact waste water collection systems and result in wholesale discharge of untreated or undertreated sewage posing long term problems to the quality of local ground water resources and public health.

Mitigation. In accordance with the current hazardous materials legislation, all existing and proposed businesses operating "Hazardous High-Risk Facilities" within the General Plan Area should be required to prepare and maintain a Hazardous Materials Management Plan, at a minimum. The information in this Plan can assist businesses, as well as, the County Fire Department and Hazardous Materials Response Units with unexpected releases of hazardous materials, especially in the event of a fire or explosion.

An inventory of all businesses that use, store, generate or transport hazardous materials as defined by the current Federal or State regulations should be performed, with response by City or County officials following an earthquake to ascertain potential releases. Existing and proposed development projects involving the use or storage of hazardous materials with regards to seismically-induced ground motions should be reviewed. Project proposals which cannot properly mitigate seismically induced hazards or pose unacceptable threats to public health and safety to the satisfaction of the City or other responsible agencies through retrofitting should be disapproved.

4.6 Earthquake-Induced Disruption to Lifeline System Impacts and Mitigating Measures.

Earthquake-Induced Disruption to Lifeline System Conclusions - Summary of Impacts. In the event of a moderate to large earthquake, all of the General Plan Area's lifeline systems, including freeways, highways and roads, railroads, and communications, as well as, natural gas, water, power, and sewage disposal systems could suffer damage. Stresses on these essential lifeline systems, in turn, can create interference with emergency personnel and operations of critical facilities, such as hospitals, schools, and essential services and other dependent care buildings. Some of the critical facilities in the General Plan Area, especially older buildings, could also be impacted by damage resulting in loss of use.

Mitigation. Require seismically resistant upgrading or retrofitting of the major lifelines (i.e. I-10, Hwy. 86, Hwy. 111, railroads, airports) within the General Plan Area and surrounding connected communities.

Programs should be implemented to promote the inventory and evaluation of earthquake hazards in existing buildings. This should also include promoting the strengthening or replacement of critical facilities, and the retrofitting or abatement of potentially hazardous buildings, highway structures, canals and reservoirs as identified by the above inventory which do not meet current or anticipated seismic safety standards.

Measures to induce building owners to upgrade and retrofit structures to render them seismically safe should be explored in the General Plan Area. The preservation and sensitive reuse of historic buildings which need strengthening for protection from seismic hazards, in a manner that does not endanger public safety should be encouraged.

The strengthening of earthquake resistance standards for non-structural components (i.e. signs, cabinets, bracing of sprinkler systems, backup power systems), especially in critical facilities, should be required, or as a minimum promoted within the General Plan Area.

The coordination capabilities of the City with other County agencies to effectively respond to earthquake and non-earthquake induced emergencies, to include heavy rescue mobilization operations and resource management, should be strengthened.

Owners or operators of critical facilities should be encouraged to maintain and regularly update emergency response plans identifying safety procedures, disaster control capabilities, and evacuation procedures such as drills and exercises.

The first section of the report discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the company's financial health and for providing reliable information to stakeholders. The second section outlines the specific procedures for recording transactions, including the use of standardized forms and the requirement for double-checking entries. The third section discusses the importance of regular audits to ensure the accuracy of the records and to identify any potential discrepancies or errors.

The fourth section of the report provides a detailed overview of the company's current financial position. It includes a summary of the company's assets, liabilities, and equity, as well as a breakdown of the company's income and expenses. The fifth section discusses the company's future financial goals and the strategies that will be implemented to achieve them. The sixth section provides a conclusion and a summary of the key findings of the report.

The seventh section of the report discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the company's financial health and for providing reliable information to stakeholders. The eighth section outlines the specific procedures for recording transactions, including the use of standardized forms and the requirement for double-checking entries. The ninth section discusses the importance of regular audits to ensure the accuracy of the records and to identify any potential discrepancies or errors.

The tenth section of the report provides a detailed overview of the company's current financial position. It includes a summary of the company's assets, liabilities, and equity, as well as a breakdown of the company's income and expenses. The eleventh section discusses the company's future financial goals and the strategies that will be implemented to achieve them. The twelfth section provides a conclusion and a summary of the key findings of the report.

The thirteenth section of the report discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the company's financial health and for providing reliable information to stakeholders. The fourteenth section outlines the specific procedures for recording transactions, including the use of standardized forms and the requirement for double-checking entries. The fifteenth section discusses the importance of regular audits to ensure the accuracy of the records and to identify any potential discrepancies or errors.

The sixteenth section of the report provides a detailed overview of the company's current financial position. It includes a summary of the company's assets, liabilities, and equity, as well as a breakdown of the company's income and expenses. The seventeenth section discusses the company's future financial goals and the strategies that will be implemented to achieve them. The eighteenth section provides a conclusion and a summary of the key findings of the report.

The nineteenth section of the report discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the company's financial health and for providing reliable information to stakeholders. The twentieth section outlines the specific procedures for recording transactions, including the use of standardized forms and the requirement for double-checking entries. The twenty-first section discusses the importance of regular audits to ensure the accuracy of the records and to identify any potential discrepancies or errors.

The twenty-second section of the report provides a detailed overview of the company's current financial position. It includes a summary of the company's assets, liabilities, and equity, as well as a breakdown of the company's income and expenses. The twenty-third section discusses the company's future financial goals and the strategies that will be implemented to achieve them. The twenty-fourth section provides a conclusion and a summary of the key findings of the report.

Section 5

Emergency Response, Preparedness and Recovery, and Research and Safety Information Systems as Presented by the Seismic Safety Commission

Section 2

Emergency Response Procedures and Plans
Research and Safety Information System
as presented by the Safety Team Committee

Section 5.0

Emergency Response, Preparedness and Recovery, and Research and Safety Information Systems

5.1 Introduction

As stated in Section 1.0, the State of California has aggressively pursued its goal to significantly improve California's earthquake safety by the year 2000. In this regard, the California Seismic Safety Commission has published several documents to address seismic safety issues, primarily as a result of damaging earthquakes. Publications have included the 1991 "California at Risk, Reducing Earthquake Hazards 1992-1996", a "California at Risk" status report prepared in 1994, and the 1995 "Northridge Earthquake, Turning Loss to Gain" report to Governor Pete Wilson. An agenda of initiatives from the first two reports have been established that will involve several state agencies, local agencies, the private sector, and volunteer groups. The State program includes 42 initiatives in five categories as follows:

1. Addressing the hazards associated with existing vulnerable facilities, including utility and transportation systems as well as buildings;
2. Improving the seismic resistance of new facilities;
3. Improving management of the emergency response and relief efforts;
4. Improving disaster recovery; and,
5. Supporting research and public information and education.

This Section addresses emergency response, preparedness and recovery, and research and safety information systems as presented in "California at Risk, Reducing Earthquake Hazards 1992-1996 as amended in the 1994 Status Report" prepared by the State of California Seismic Safety Commission. Those initiatives that are important to the city of Coachella are presented in the following pages as reproductions of the original publications.

Executive Summary

California is earthquake country. Damaging earthquakes can occur almost anywhere in the state. Studies on a few of the larger and better known faults conclude that major earthquakes are likely at any time within a few decades. Many other active faults are much less well understood, and still others remain undiscovered. Damaging earthquakes can occur on any of these faults, although the location and timing cannot be predicted with precision.

The probability of damaging earthquakes is high. A group of our most knowledgeable scientists has estimated that the chance of a major earthquake striking southern California within the next 30 years is 60 percent, while in the Bay Area it is 67 percent. This means there is over a 90 percent chance that at least one major earthquake (over magnitude 7.0) will strike an urban area in California within the next decade or so. As in the past, we can count on smaller but still damaging earthquakes to strike about every two years.

Much of what needs to be done to reduce earthquake hazards and manage risk is already understood and simply needs to be put into effect. We also have a good grasp of the kinds of further research and new knowledge that would most help in promoting earthquake safety. With diligent effort and a commitment of resources, California can be made reasonably secure against earthquake damage and disruption.

This should remain a high-priority goal for the state government, which has a primary duty to assure public safety. California's cities and residents will remain at risk until the serious earthquake threat is reduced by public and private-sector action. Recognizing this continuing threat, the California Earthquake Hazards Reduction Act of 1986 calls for a significant reduction of earthquake hazards by the year 2000.

California at Risk compiles California's five-year program of earthquake hazard

reduction, aimed at meeting the year-2000 goal. It sets forth priorities, project schedules, funding sources, amounts, and activities (termed "initiatives"). Appendix A describes California's current program of hazard reduction, emergency response, and disaster recovery. Progress under the first five-year program, adopted in 1986, is documented in Appendix B.

The second five-year program, contained herein, reflects progress made and insights gained in the first five years. Post-earthquake observations and research after Whittier Narrows (1987) and Loma Prieta (1989) have also provided guidance for the Seismic Safety Commission and the other 43 state agencies that have responsibility to help carry out the program to reduce earthquake hazards.

The 42 initiatives in this latest *California at Risk* outline a comprehensive hazard reduction program that will significantly improve the state's ability to withstand earthquakes (Table I). Some 150 program milestones are provided to measure progress, record accomplishments, and help keep the program on schedule. The initiatives complement present programs carried out by state and local governments, schools, private-sector enterprises, and volunteer agencies. They provide policymakers a way of assessing the rate of progress toward the ultimate goal. The action plans, tables V through IX, enumerate activities and milestones for each calendar year of the program, and identify responsible organizations.

These initiatives, integrating action by both the public sector and the private sector, are organized into five categories:

- *Category 1:* 19 initiatives that encourage hazard reduction in existing vulnerable facilities.
- *Category 2:* 5 initiatives that encourage hazard reduction in new facilities.
- *Category 3:* 9 initiatives to encourage improvements in emergency management.

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- *Category 4:* 5 initiatives to expedite the disaster recovery process.
- *Category 5:* 3 initiatives to assist research and education.

California at Risk is an ambitious agenda requiring the cooperation and participation of diverse organizations and agencies. Progress on a number of initiatives will require action by both the Governor and the Legislature to establish policy assigning new responsibilities, granting new authority, and appropriating additional fiscal resources. For its part, the Commission will continue to participate in and monitor this program through public hearings, reports, and workshops. It will function as a facilitator to

integrate activities, coordinate individual actions, and assist the primarily responsible agencies in every possible way.

In 1997, at the end of this five-year program, we will be very close to the year 2000 deadline for significantly reducing earthquake-related hazards that has been set by the Legislature and the Governor. If we are to reach our goal, all players must understand not only the specifics of individual initiatives, but the general scheme into which they fit. To aid in both, this summary includes a list of the initiatives with a summary of each followed by a table showing the lead agency for each initiative and the year it is scheduled to start.

Summary of Initiatives

Category 1: Existing Vulnerable Facilities

- 1.1—*Establish Seismic Evaluation and Retrofit Building Standards.* The greatest stumbling block to retrofit efforts is the lack of standards for existing buildings. This initiative will focus on greater state involvement in standards development.
- 1.2—*Improve Safety of Older Hospital Buildings.* An initiative in the first five year program focused on identifying the scope of the earthquake hazards in existing hospital buildings. This second five year program will create a seismic hazard mitigation program for these buildings.
- 1.3—*Improve Safety of Older Public School Buildings.* While public school buildings constructed under the Field Act have performed well in past earthquakes, earlier building code standards permitted construction of certain types of potentially hazardous buildings, especially nonductile concrete buildings. A statewide hazard identification and reduction effort is needed for the small but significant percentage of such potentially hazardous, public school buildings.
- 1.4—*Develop Falling Hazard Guidelines for State Buildings.* The state can greatly reduce the damaging effects of moderate ground shaking by reducing hazards of

falling objects through building maintenance policies.

- 1.5—*Improve Safety of State-Owned Buildings.* This initiative builds on the first five years of effort that obtained a \$250 million funding source for seismic hazard reduction projects, and sets a goal for achieving acceptable levels of earthquake risk in state buildings by the year 2000.
 - 1.6—*Improve Essential Services Buildings.* A 1986 law requires new essential services buildings to be constructed to withstand earthquakes without a loss of operations. This initiative focuses on reducing seismic hazards in essential services buildings built before 1986.
 - 1.7—*Improve Safety of Older High-Occupancy Buildings.* In future earthquakes hundreds of lives could be lost in the collapse of just one nonductile concrete building containing a large number of people. This initiative focuses on the most suspect buildings with the highest potential for loss of life and injury.
 - 1.8—*Improve Safety of Homes.* Information about typical earthquake hazards in homes should be disclosed on their sale.
 - 1.9—*Improve Safety of Mobile Homes.* Retrofit programs are proposed to address the known earthquake vulnerabilities of mobile homes.
 - 1.10—*Preserve Historic Buildings.* Unless seismic resistance of the most important
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and vulnerable historic buildings is addressed, California stands to lose irreplaceable parts of its cultural heritage.

- 1.11—*Reduce Workplace Hazards.* Cal/OSHA is responsible for enforcing minimum workplace safety requirements. This initiative will clarify that their responsibility includes earthquake safety.
- 1.12—*Review Safety of Federal Dams.* The state should assure that design practice for all federal dams in California provides an acceptable level of risk that is comparable to the state's practice.
- 1.13, 1.14, 1.15—*Improve Earthquake Performance of Power and Gas, Water, and Sanitation Systems.* These initiatives propose to develop comprehensive policies on acceptable levels of earthquake risk for these key lifelines.
- 1.16—*Improve Earthquake Performance of Transportation Structures.* Hundreds of older highway and railroad bridges are in need of seismic retrofit.
- 1.17—*Improve Earthquake Performance of Offshore Oil Facilities.* Extending the service life of existing offshore hydrocarbon production facilities in state and federal waters requires development of a standard procedure and guidelines to requalify such production facilities.
- 1.18—*Improve Performance of Transportation Systems and Infrastructure.* Commerce depends on a number of transportation systems including ports, airports, railroads, pipelines and producers. Acceptable earthquake performance of these systems should be determined.
- 1.19—*Clarify Liability Concerns of Seismic Hazard Mitigation.* Tort liability issues for building owners and design professionals should be addressed.
- 1.20—*Develop Legal Recommendations for Seismic Hazard Mitigation.* Guidelines are needed to assure that hazard reduction efforts are promoted without improperly infringing on owners' rights.

Category 2: New Facilities

- 2.1—*Improve Seismic Standards for New Construction.* The state should actively encourage the improvement of seismic standards for new construction.
- 2.2—*Map Geologic Hazards.* Rapid implementation of the state's new seismic

hazards mapping program is crucial to improved seismic safety.

- 2.3—*Establish Independent Seismic Design Review Policies.* The Commission should encourage the use of independent seismic design reviews as a cost-effective way to improve seismic safety.
- 2.4—*Improve State Agencies' Seismic Design and Construction Practices.* The state should protect its investment in buildings and other structures through independent review and greater efficiency, accountability, and flexibility by its construction practices.
- 2.5—*Improve Design and Construction Seismic Safety Training.* The state should encourage the building professions to take a more active role in continuing education for their members regarding the many developments in seismic safety.

Category 3: Emergency Response Management

- 3.1—*Improve Emergency Communications System.* This is the highest emergency response priority. All management actions during an emergency require communications. The Loma Prieta earthquake demonstrated unacceptable weaknesses.
- 3.2—*Improve Emergency Management System.* An integrated standard emergency management system needs to be established and used by all levels of government.
- 3.3—*Improve Mutual Aid.* The ability of jurisdictions unaffected by an earthquake to provide assistance to damaged jurisdictions needs to be expanded to include all government functions.
- 3.4—*Improve Medical Mutual Aid.* Medical mutual aid presents different problems than mutual aid for government services (Initiative 3.3) because of the mix of private and public
- 3.5—*Determine Emergency Medical Care Needs.* The Emergency Medical Services Authority should estimate the number of hospital beds needed after a major earthquake so that medical communities can ensure adequate care.
- 3.6—*Improve Shelter Planning.* Emergency shelters providing interim housing for earthquake victims are now needed for

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longer periods and require more support services than previously anticipated.

- 3.7—*Improve Professional Qualifications of Emergency Managers.* As management systems become more complex, emergency managers must receive additional training.
- 3.8—*Reduce the Risk of Hazardous Materials Release in Earthquakes.* The potential for earthquake-caused releases of hazardous materials requires that owners and regulators consider earthquake hazards in the manufacture, transportation, storage, use, and disposal of such
- 3.9—*Improve Earthquake Performance of Telephone Systems.* The flood of telephone calls immediately after earthquakes requires improvement of the telephone system's ability to withstand earthquake forces and to maintain essential communication capabilities.

Category 4: Disaster Recovery

- 4.1—*Implement Recovery Guidelines.* Cities and counties need to plan ahead to expedite and shape community earthquake recovery.
- 4.2—*Initiate a State Recovery Plan.* Individual state agencies need to assure that they can deliver or restore necessary services promptly after an earthquake.
- 4.3—*Estimate Economic and Governmental Impacts.* A study of the effects of a major urban earthquake on the state's economy and government functions is needed to

guide the future allocation of state resources.

- 4.4—*Develop Rubble Disposal Strategy.* Dumping rubble into the bay or ocean, as was done after the 1906 San Francisco earthquake, is no longer acceptable. Alternatives must be
- 4.5—*Provide Post-Earthquake Housing.* Finding interim and long-term housing for low-income earthquake victims involves different government agencies from those involved in emergency shelters. A plan is needed to reduce future losses and rapidly replace damaged buildings.

Category 5: Research and Information/Education

- 5.1—*Implement an Earthquake Research Plan.* Research investigations that will do the most to reduce California's earthquake hazards should be identified, funded, carried out, and the results disseminated to users.
- 5.2—*Establish a Coordinated Earthquake Information Strategy.* A plan should be developed to deliver appropriate earthquake information to all segments of the public.
- 5.3—*Identify and Reduce Tsunami Hazards.* State and federal agencies will assess the risk of tsunamis—earthquake-triggered ocean waves that can devastate coastal areas—and propose an appropriate hazard reduction program.
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Table I—The Initiatives

<i>No.</i>	<i>Title</i>	<i>Lead Agency</i>	<i>Scheduled Start</i>
Category 1—Existing Vulnerable Facilities			
1.1	Establish Seismic Evaluation and Retrofit Building Standards	SSC	1991
1.2	Improve Safety of Older Hospital Buildings	OSHDP	1992
1.3	Improve Safety of Older Public School Buildings	OSA	1991
1.4	Develop Falling Hazard Guidelines for State Buildings	BSC	1991
1.5	Improve Safety of State-Owned Buildings	OSA	1991
1.6	Improve Essential Services Buildings	OSA	1992
1.7	Improve Safety of Older High-Occupancy Buildings	SSC	1991
1.8	Improve Safety of Homes	HCD	1991
1.9	Improve Safety of Mobile Houses	SSC	1991
1.10	Conserve Historic Buildings	SHBSB	1992
1.11	Reduce Workplace Hazards	Cal/OSHA	1992
1.12	Review Safety of Federal Dams	DWR	1992
1.13	Improve Earthquake Performance of Power and Gas Systems	PUC	1991
1.14	Improve Earthquake Performance of Water Systems	DWR	1992
1.15	Improve Earthquake Performance of Sanitation Systems	DWR	1992
1.16	Improve Earthquake Performance of Transportation Structures	Caltrans	1991
1.17	Improve Earthquake Performance of Offshore Oil Facilities	SLC	1992
1.18	Improve Performance of Transportation & Infrastructure	SSC	1992
1.19	Clarify Seismic Hazard Mitigation Liability Issues	SSC	1992
1.20	Develop Suggested Civil Procedures for Seismic Hazard Mitigat.	SSC	1992
Category 2—New Facilities			
2.1	Improve Seismic Standards for New Construction	BSC	1992
2.2	Map Geologic Hazards	DMG	1991
2.3	Establish Independent Seismic Design Review Policies	SSC	1992
2.4	Improve State Agencies' Seismic Design & Construction Practic.	SSC	1992
2.5	Improve Seismic Safety Training of Professionals	SSC	1992
Category 3—Emergency Response Management			
3.1	Improve Emergency Communications System	OES	1991
3.2	Improve Emergency Management System	OES	1992
3.3	Improve Mutual Aid	OES	1992
3.4	Improve Medical Mutual Aid	OES	1992
3.5	Determine Emergency Medical Care Needs	EMSA	1992
3.6	Improve Shelter Planning	DSS	1992
3.7	Improve Professional Qualifications of Emergency Managers	OES	1992
3.8	Reduce the Risk of Hazardous Materials Release in Earthquakes	OES	1992
3.9	Improve Earthquake Performance of Telephone Systems	PUC	1992
Category 4—Disaster Recovery			
4.1	Implement Recovery Guidelines	SSC	1992
4.2	Initiate a State Recovery Plan	SSC	1992
4.3	Estimate Economic & Governmental Impacts	SSC	1991
4.4	Develop Rubble Disposal Strategy	BCDC	1992
4.5	Provide Post-Earthquake Housing	HCD	1992
Category 5—Research and Information/Education			
5.1	Implement an Earthquake Research Plan	SSC	1991
5.2	Establish a Coordinated Earthquake Information Strategy	SSC	1992
5.3	Identify and Reduce Tsunami Hazards	SSC	1993

Key to Table I:

BCDC	San Francisco Bay Conservation and Development Commission
BSC	Building Standards Commission
Cal/OSHA	California Occupational Safety and Health Administration
Caltrans	Department of Transportation
DMG	Department of Conservation, Division of Mines and Geology
DSS	Department of Social Services
DWR	Department of Water Resources
EMSA	Emergency Medical Services Authority
HCD	Department of Housing and Community Development
OES	Governor's Office of Emergency Services
OSA	Office of State Architect
OSHDP	Office of Statewide Health Planning and Development
PUC	Public Utilities Commission
SHBSB	State Historical Building Safety Board
SSC	Seismic Safety Commission

Category 3

Emergency Response Management

Major earthquakes will continue to occur in California urban areas. Many buildings and other structures will be damaged, and many people will be injured or killed. This certainty demands that a high priority be placed on improving the abilities of emergency managers to respond to disaster needs. Because emergency response was successful in the Whittier Narrows and Loma Prieta earthquakes, there seems to be a general perception that California is ready to respond to major urban earthquakes, although evaluation of these emergencies clearly shows we are not.

Every earthquake points out the same flaws in our emergency management systems, but resources are not provided to make needed improvements. California's emergency responders at both the state and local levels have good plans and concepts for dealing with an earthquake, but they have not received funding for the communications equipment, training, and facilities needed to use these plans effectively. Local governments, facing severe budget shortfalls, have even reduced or eliminated their emergency management staffs. Immediately after an earthquake, it is too late to recruit needed personnel, provide training and put equipment and systems into operation. The interest in committing resources for earthquake preparations fades even more rapidly than the memory of the event.

Some improvements in earthquake preparations have been taking place. During the last five years the state has adopted an emergency response plan that describes catastrophic emergency operations for an event that exceeds the capability of the affected jurisdiction and its mutual aid partners, and the federal government has adopted a catastrophic disaster response plan that should ensure quicker flow of federal resources to areas affected by a disaster. Some communities are deeply concerned and are doing what they can to improve their own preparations, and the private sector is beginning to establish

closer ties and partnerships with state and local governments.

Nevertheless, a major earthquake in an urban area will place demands on emergency managers and responders that will exceed their capabilities and resources. It will result in many times the number of damaged buildings and structures and casualties experienced in the Loma Prieta earthquake, and overtax mutual aid agreements between neighboring jurisdictions. The potential for saving lives and reducing property damage, especially from fire, can and must be increased by improving emergency management and response capability (trained personnel, facilities, and equipment) and response plans.

We are living on borrowed time. Unless local jurisdictions, supported by the State act, quickly establish an effective emergency management program with the trained professionals, equipment, and facilities to support the plans, catastrophic earthquakes will occur before California's emergency managers and responders are adequately prepared.

Emergency managers who responded to the Loma Prieta and Whittier Narrows earthquakes and emergency management experts who evaluated these responses identified the following objectives to guide the development of initiatives in this category:

- Install an improved and reliable means of communication for all levels of emergency managers.

It has long been recognized that the ability of an emergency manager to react to quickly changing situations depends on the ability to communicate reliably with the damage assessors, resource suppliers, resource users, and all of the public support functions. Effective and reliable communications are the foundation of any successful emergency management system. To recognize and support the need for communications improvements, this requirement is identified as the first priority of Category 3.

- Adopt a common system of emergency management that is understood,

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accepted, and used by all state, regional, and local emergency managers.

The use of a common management process by all levels of the emergency management system will create significant improvements in emergency operations and is the ultimate objective. An improved system will improve every emergency manager's ability to request and direct trained personnel effectively from any source including outside the damaged area.

- Provide professional certification and recognition for emergency managers. A management system complex and responsive enough to meet the interactive needs among the many levels of government demands professional managers. A certification program for emergency managers will recognize their professional emergency management skills and encourage all levels of government to select a qualified manager to run the system.

- Schedule regular exercises and training for full-time and augmentation personnel at all levels of the emergency management system.

Emergency management professionals, elected officials and other managers will be no better than their training program. An integral part of any training program are exercises that test the individuals as well as the system. The first joint state/federal earthquake response exercise, held in Sacramento just prior to the Loma Prieta earthquake, proved extremely helpful to those who responded to the earthquake.

- Ensure that essential services, facilities, such as emergency operations centers, fire and police stations, and communications facilities, are capable of operating after an earthquake.

Initiative 3.1**Improve Emergency Communications System**

Successful emergency management depends on reliable communications for decisionmakers. Experience in the Loma Prieta earthquake highlighted the unreliability of the state's current emergency communications systems even though conventional landline and cellular telephone systems generally remained in operation. It demonstrated once again that reliable communications systems with effective backups are required to manage emergency responses in a disaster.

Emergency managers were able to use commercial cellular telephones after Loma Prieta. These systems continue to grow and their ability to provide emergency communications has been enhanced since 1989. However, damage to cellular antenna towers and rapidly increasing traffic on the cellular phone system could prevent it from providing effective communications in future earthquakes, unless an effective mechanism is established by the federal government to set call priorities.

In July 1989, the Office of Emergency Services developed a proposal for a satellite emergency communications system to form the backbone of a new, reliable primary state emergency system.

Objective

By December 1996, the Office of Emergency Services establishes a communications system for emergency management that is effective and reliable.

Milestones

1. By December 1992, the Office of Emergency Services decides what improvements may be needed to communicate with utility companies and meet medical requirements described in Initiative 3.5.
2. By December 1993, the Department of General Services updates the State Telecommunications Plan to include the satellite communications system.

Resources Needed

State: The satellite system costs are estimated as \$13.65 million in capital outlay for equipment and ground sites and \$1.04 million each year for operation and maintenance.

Local: The cost to provide communications network equipment for each county emergency operating center is included in the state total.

Responsible Agencies

Office of Emergency Services (Mike Guerin, Assistant Director, Response and Recovery)

California Emergency Services Association (Jim Bohon, President)

Seismic Safety Commission (J.F. Goodfellow, Planner)

Caltrans, Division of Maintenance (Dale TenBroeck, Chief, Office of Emergency Management)

Department of General Services, Division of Telecommunications (Fred Guston, Deputy Director)

Local Governments

Status

State: Funding to purchase this system was in the 1990/91 state budget but was frozen by an unexpected revenue shortfall.

References

1. Office of Emergency Services, *California Emergency Plan*
2. Seismic Safety Commission, *Earthquake Emergency Preparedness and Response*, SSC 90-08, 1990
3. Office of Emergency Services, SA-002 Satellite Communications Ground Terminals, Sept 1990
4. Government Code Section 8550, Emergency Services Act
5. Government Code Section 15277, Annual Report to the Legislature on State Telecommunications
6. Department of General Services, 9-1-1 Disaster Preparedness Report, April 15, 1991

Initiative 3.2

Improve Emergency Management System

Differences in operating procedures and levels of proficiency among the state, regional and local levels of government makes it difficult to coordinate effective emergency response. This same problem has been reported after each of the last three damaging California earthquakes. A commonly accepted management system that is tested and used by all levels of government is needed to improve coordination of emergency responses.

Objective

By **December 1996**, the Office of Emergency Services requires all state agencies to use a standardized management system to coordinate emergency operations after earthquakes, and encourage local jurisdictions to use the same system.

Milestones

1. By **December 1992**, the Office of Emergency Services, in consultation with other interested parties, encourages use of a standardized emergency management system by all levels of government.
2. By **December 1993**, the Office of Emergency Services and the California Specialized Training Institute, in conjunction with local governments, evaluates existing training and establishes appropriate guidelines for future training using the standard system of emergency management.
3. By **July 1994**, the Office of Emergency Services and the California Specialized Training Institute offers training as required to meet the guidelines for emergency management established in Milestone 2. This training should be aimed at regional and local emergency managers and augmentation/volunteer personnel.

Resources Needed

State: The Office of Emergency Services may need additional resources to carry out this initiative. If local government is required to use this system to train, the state may incur

state-mandate costs of about \$3 million per year for four years. State costs include revisions to the State Emergency Plan. **Local:** The costs to revise local plans and train personnel is about \$12 million. Costs can be minimized if charges and training are integrated into ongoing programs.

Responsible Agencies

Office of Emergency Services (Eileen Baumgardner, Assistant Director, Plans)
 Local Governments
 California Emergency Services Association (Jim Bohon, President)
 State Fire Marshal (David Walizer, Assistant State Fire Marshal)
 Caltrans, Division of Maintenance (Dale TenBroeck, Chief, Office of Emergency Management)
 California Peace Officers Association (Jack Gardner, POST)
 Seismic Safety Commission (J.F. Goodfellow, Planner)
 U.S. Army Corps of Engineers, Sacramento District, Emergency Management Division (Mark Verke, Chief EM Division)
 Federal Emergency Management Agency, Region IX (Nick Nikas, Disaster Response)

Status

The Office of Emergency Services request for proposal #E1-91 is awaiting funding and the California Emergency Plan encourages the use of the Incident Command System and the ICS working groups.

References

1. Government Code Section 8550, Emergency Services Act
2. Office of Emergency Services, *California Emergency Plan*
3. Office of Emergency Services RFP #E1-91, Operational Area Emergency Information Management System
4. Seismic Safety Commission, *Earthquake Emergency Preparedness & Response*, SSC 90-08, 1990
5. Federal Emergency Management Agency, *Federal Natural Disaster Response Plan* (Draft), November 1990

Initiative 3.3

Improve Mutual Aid

Communities affected by major disasters need more than fire and law enforcement help. Although mutual aid agreements between local jurisdictions are frequently used to provide fire and police augmentation when needed, other kinds of resources also need to be made available when emergency demands exceed the capabilities of a damaged city or county.

The California Master Mutual Aid Agreement provides general procedures, but more specific agreements need to be developed to include assistance for all resources that may be needed for emergency response and recovery and resolve questions about liability.

Objective

By December 1994, the Office of Emergency Services establishes a system that allows local jurisdictions to get timely support from outside the damaged area for any governmental service that has been disabled or overextended.

Milestones

1. By December 1992, the Office of Emergency Services improves the mutual aid system and develops a process to provide augmentation for all government functions during an emergency.
2. By December 1993, the Office of Emergency Services and the California Specialized Training Institute provide training to local jurisdictions on procedures to access mutual aid to support all kinds of government functions following a disaster.

Resources Needed

State: Office of Emergency Services may require additional funding for the administrative costs to implement this initiative during the process of updating the State Emergency Plan.

Local: Local jurisdictions may incur minimal administrative costs to complete mutual aid agreements.

Responsible Agencies

Office of Emergency Services (Eileen Baumgardner, Assistant Director, Plans)
California Emergency Services Association (Jim Bohon, President)
Seismic Safety Commission (J.F. Goodfellow, Planner)
Local Governments

Status

Office of Emergency Services has prepared a *Mutual Aid Handbook* for printing in 1991 and a federal grant is pending to address common reporting and requesting procedures.

References

1. Government Code Section 8550, Emergency Services Act
2. Seismic Safety Commission, *Earthquake Emergency Preparedness and Response*, SSC 90-08, 1990

Initiative 3.4

Improve Medical Mutual Aid

Although there were few casualties in California's last three damaging earthquakes, the health care system demonstrated two weaknesses that must be overcome before major urban earthquakes: (1) the inability of the medical and emergency management systems to communicate quickly and effectively with each other and (2) the lack of widespread mutual aid agreements that can augment health care when and where needed.

Health care services are provided by many public and privately owned facilities, yet the system must operate as a whole to care for the injured. The medical emergency management system must be able to coordinate assistance and augment local providers as necessary. A commonly accepted system of support and financial agreements between the public and private medical providers is needed to improve the support of emergency responses. This mutual support must be integrated into the emergency management system through a communications system linking the managers of private and public medical services with the emergency managers.

Objective

By **December 1993**, the Emergency Medical Services Authority and the Office of Emergency Services improve the medical mutual aid system used by local, regional, and state agencies to coordinate emergency medical needs after an earthquake.

Milestones

1. By **July 1992**, the Emergency Medical Services Authority, in consultation with the Office of Emergency Services and the public and private medical providers, determines improvements needed in medical mutual aid, including communication needs.
2. By **December 1992**, the Office of Emergency Services incorporates appropriate changes in the State Emergency Plan.
3. By **July 1993**, the Office of Statewide Health Planning and Development

incorporates appropriate changes in the State Health Plan.

Resources Needed

State: Absorbable administrative costs will cover this initiative. Emergency Medical Services Authority and the Office of Emergency Services may need funds to revise the State Emergency Plan. The costs to include medical communications in the state emergency communications system should be part of Initiative 3.1.

Responsible Agencies

Emergency Medical Services Authority (Calvin Freeman, Chief, Disaster Medical Services)
Office of Emergency Services (Eileen Baumgardner, Assistant Director, Plans)
Office of Statewide Health Planning and Development, Division of Health Products and Analysis (M.H. Gerould, Deputy Director)
Department of General Services, Telecommunications Division (Mark Phigler, Deputy Director)
Local Governments
California Emergency Services Association (Jim Bohon, President)
California Association of Hospitals and Health Services (Susan Harris, Vice President)
Seismic Safety Commission (J.F. Goodfellow, Planner)

Status

To be started.

References

1. Government Code Section 8550, Emergency Services Act
2. Office of Emergency Services, *California Emergency Plan*
3. Seismic Safety Commission, *Earthquake Emergency Preparedness & Response*, SSC 90-08, 1990
4. Health and Safety Code Section 439.5, State Health Plan
5. Government Code Section 15277, *Annual Report to the Legislature on State Telecommunications*

Initiative 3.5**Determine Emergency Medical Care Needs**

Not enough is known about emergency medical care needs following major urban earthquakes or the extent to which acute-care hospitals will be available to provide assistance. Better estimates of the potential casualties and hospital facilities, available after earthquakes, are needed to provide guidance for planning alternative emergency medical strategies.

Many of the state's 490 acute-care hospitals were built prior to the 1973 Alquist Hospital Seismic Safety Act which requires new hospitals to remain functional after disasters. However, only a few of these older hospitals have been upgraded to comply with the new standards. Moreover, emergency medical treatment sources are rapidly expanding beyond acute care hospitals. Current trends toward decentralized medical specialty clinics and expanded out-patient services may offer emergency care for casualties not adequately incorporated in previous studies of the emergency medical system.

The needs for casualty care and the availability of treatment alternatives should be considered in Initiative 1.2 when establishing priorities and schedules for improving the performance of older hospitals, the state's medical mutual aid system, and other emergency plans.

Objective

By December 1994, the Emergency Medical Services Authority, the Department of Health Services, the Office of Emergency Services, and the Office of Statewide Health Planning and Development include provisions in appropriate plans to ensure that adequate emergency medical services will be available following a major urban earthquake.

Milestones

1. By July 1993, the Emergency Medical Services Authority, in consultation with Office of Statewide Health Planning and Development, Department of Health Services, and other interested organizations, completes a study to

identify health care services needed after major urban earthquakes and recommends actions to provide post-earthquake emergency medical services.

2. By December 1994, the Office of Statewide Health Planning and Development incorporates the results of the Milestone 1 study into the State Health Plan and Initiative 1.2.
3. By December 1994, the Office of Emergency Services includes the results in state emergency planning guidance.

Resources Needed

State: Minor additional administrative costs should not require additional funding.

Responsible Agencies

Emergency Medical Services Authority (Calvin Freeman, Chief, Disaster Medical Services)
Office of Statewide Health Planning and Development (Gary Pettigrew, Deputy Director)
Department of Health Services (Harry Collins, Deputy Director, Public Health)
Office of Emergency Services (Eileen Baumgardner, Assistant Director, Plans)
California Association of Hospitals and Health Services (Susan Harris, Vice President)
Seismic Safety Commission (J.F. Goodfellow)
Kaiser Permanente (Marilee Miller, Disaster Contingency Planning)

Status

To be started.

References

1. Health and Safety Code Section 15020 *et seq.*
2. Seismic Safety Commission, *Earthquake Emergency Preparedness and Response*, SSC 90-08, 1990
3. Building Safety Board, *California at Risk* Milestone 4 Report, December 1990
4. Office of Statewide Health Planning and Development
5. Health and Safety Code Section 1797.121
6. Health and Safety Code 439.3, *State Health Plan*
7. Office of Emergency Services, *California Emergency Plan*

Initiative 3.6

Improve Shelter Planning

The last three damaging California earthquakes demonstrated the need to plan and designate short-term and long-term shelters, improve the ability of shelter managers to assist ethnic groups and economically disadvantaged, and otherwise improve shelter operations.

Cities and counties need to identify shelters in advance. During the Loma Prieta quake, about 12,000 people left homeless swamped the shelters. Eighteen months after the quake, little long-term and low-income housing was replaced; many were still living in temporary housing. The large number of people requiring long-term shelters was not anticipated. Local governments must be ready for them next time.

Objective

By December 1992, the Office of Emergency Services, in consultation with the listed agencies and organizations, improves shelter planning to designate short- and long-term shelters and temporary housing, provide liaison and outreach services for ethnic groups and encourage training of additional shelter managers.

Milestones

1. By July 1992, the Department of Social Services, in consultation with the Department of Housing and Community Development, the American Red Cross, Federal Emergency Management Agency and Office of Emergency Services, begins developing structure, policies and guidance to provide long- and short-term shelters, temporary housing, and liaison services.
2. By December 1993, the Office of Emergency Services includes this guidance in the state emergency plan.

Resources Needed

State: Administrative costs should be part of the overall disaster preparation and response services of the Department of Social Services and Office of Emergency Services.

Local: Jurisdictions may need additional support from Office of Emergency Services for training and local emergency planning assistance.

Responsible Agencies

Department of Social Services (Lee Sapaden, Manager, Disaster Response Services)
Office of Emergency Services (Eileen Baumgardner, Assistant Director, Plans)
Department of Housing and Community Development (Dan Pennington, Chief, Division of Community Affairs)
American Red Cross
Salvation Army
Federal Emerg. Management Agency (David Vargo, Volunteer Services, Region IX)
Seismic Safety Commission (J.F. Goodfellow, Planner)
California Emergency Services Association (Jim Bohon, President)

Status

Some of the agencies involved have held preliminary meetings.

References:

1. Government Code Section 8550, Emergency Services Act
2. State Emergency Plan, Annex G
3. Seismic Safety Commission Report, *Earthquake Emergency Preparedness & Response*, SSC 90-08, 1990
4. State FY 90/91 budget item 8940-001-001
5. Health and Safety Code Section 34070
6. American Red Cross, Northern California Earthquake Relief and Preparedness Project

Initiative 3.7**Improve Professional Qualifications of Emergency Managers**

Emergency managers urgently need to become better qualified to meet the challenge of providing efficient and effective emergency management. Education, awareness of current issues and concerns, and knowledge of modern management techniques are the most effective tools a manager can use when responding to and recovering from natural and human-caused disasters.

The professional standing of emergency managers is not recognized formally because emergency management only recently was seen as a speciality. Preparation for this profession is limited by the absence of an academic curriculum and courses in universities. Moreover, there are no continuing education requirements that assure those in the profession stay abreast of advances in this rapidly changing field. The lack of recognition for professional qualifications makes it difficult for local officials and private sector managers to judge professional qualifications when selecting an emergency manager. The Federal Emergency Management Agency, the National Coordinating Council on Emergency Management, and the California Emergency Services Association have recognized this problem. These organizations are currently developing professional certification programs for emergency managers.

Objective

By December 1996, the Office of Emergency Services improves the use of qualified emergency managers by recognizing and encouraging certification programs.

Milestones

1. By July 1993, the Office of Emergency Services holds a conference of all concerned organizations to develop and recognize a certification program for emergency managers.
2. By December 1993, the California Emergency Services Association and the National Coordinating Council On

Emergency Management provides certification for emergency managers.

3. By December 1994, the Office of Emergency Services provides guidance to local governments on the qualifications of emergency managers and determines the incentives and requirements needed to encourage the employment of certified professionals.

Resources Needed

State: Minor added costs for the Office of Emergency Services to meet with local and statewide emergency planning councils.

Local: Expected to be negligible since professional certification can be done via personnel policies over several years.

Private: Minor costs for professional organizations.

Responsible Agencies

California Specialized Training Institute (John Mirolla, Director)

California Emergency Services Association (Jim Bohon, President)

National Coordinating Council On Emergency Management (Elizabeth Buzzerd Armstrong, Executive Director)

Seismic Safety Commission (J.F. Goodfellow, Planner)

League of California Cities

County Supervisors Association of California

Status

A certification program was started by the California Emergency Services Association. CESA is preparing to offer a professional certificate in emergency management.

The National Coordinating Council On Emergency Management is funded by the Federal Emergency Management Agency to prepare a national certification program expected to begin in 1993.

References

1. California Emergency Services Association, Certified Emergency Management Professional Program
2. National Coordinating Council On Emergency Management, Phase III, National Certification Program

Initiative 3.8**Reduce the Risk of Hazardous Materials Release in Earthquakes**

Earthquakes cause hazardous material releases capable of endangering people nearby as well as the public over a large area. A chlorine leak after the Whittier Narrows earthquake created a toxic cloud over portions of Santa Fe Springs. The Loma Prieta earthquake damaged two petrochemical plants in Richmond miles from the epicenter, caused spills in laboratories at Stanford and Berkeley, and released 10,000 pounds of anhydrous ammonia inside a Watsonville warehouse. This complicates emergency response operations and demonstrates that emergency responders must anticipate hazardous material emergencies after earthquakes.

Existing hazardous materials programs do not deal uniformly with hazards caused by earthquake performance of new or existing buildings, or facilities located in areas of potential ground failure. Current programs address the daily problems of spills and leaks, single incident emergencies. Local governments, usually the fire department and private sector teams can only deal with a limited number of isolated releases at one time. Earthquakes can cause a number of simultaneous hazardous material releases, at the time when the hazardous materials emergency responders are already overwhelmed with other incidents.

Hazardous materials programs should be coordinated with state and federal seismic safety programs to identify hazardous facilities, set design criteria, and identify areas of geologic hazards so that facilities containing quantities of hazardous materials sufficient to pose a risk to more than immediate handlers and complicate emergency response are adequately prepared.

Those responsible for the manufacture, transportation, storage, use and disposal of hazardous materials of a nature and quantity that can cause emergency response concerns, should consider earthquakes in the design, retrofit and operation of their facilities.

Federally owned or operated activities in Seismic Zone 4 should use the same standards as state and local jurisdictions require for construction, emergency planning and response.

Objective

By December 1996, the Chemical Emergency Planning and Response Commission amends regulations for the manufacture, transportation, storage, use and disposal of materials of a nature and in quantities capable of causing life threatening incidents to minimize the release of hazardous materials in earthquakes.

Milestones

1. By December 1992, the Seismic Safety Commission recommends to the Chemical Emergency Planning and Response Commission (CEPRC) actions to improve seismic safety.
2. By December 1992, the Office of State Fire Marshal adopts Article 80 of the Uniform Fire Code regarding standards for hazardous materials storage.
3. By July 1993, the Office of Emergency Services includes actions necessary to improve the hazardous materials safety of responders and the public during earthquakes in appropriate guidance to emergency managers.
4. By July 1994, owners begin improving the seismic resistance of their buildings and hazardous materials storage systems that contain quantities of hazardous materials sufficient to cause a significant threat to public safety.
5. By December 1995, the Seismic Safety Commission and the Chemical Emergency Planning and Response Commission establishes a process to encourage federal facilities that use, store, transport or dispose hazardous materials to meet California seismic safety standards.

Resources Needed

State: The Seismic Safety Commission will require 1/2 PY and \$20,000 to prepare the report in milestone 1 and to work with the building code agencies.

Local: An increase in local government expenses is not expected since regulatory and response programs are already in place.

Private: Data is not available to project the cost to mitigate the risk of facilities considered potentially hazardous in an earthquake.

Responsible Agencies

Chemical Emergency Planning and Response Commission (Richard Andrews, Chair)

Office of Emergency Services (Paul Penn, Title III, SARA, Program Manager)

Office of the State Fire Marshal (Manny A. Muniz, Deputy State Fire Marshal)

California Environmental Protection Agency (Glenn Brank, Deputy Director, Communications)

Seismic Safety Commission (J.F. Goodfellow, Planner)

U.S. Army Corps of Engineers, Sacramento District (Mark Verke, Chief, Emergency Management Division)

Sacramento Air Logistics' Center, Directorate of Environmental

Management McClellan Air Force Base, Sacramento (Paul Brunner, Director)

Status

The Office of State Fire Marshal is holding hearings to adopt Article 80 of the 1991 Uniform Fire Code. Further efforts remain to be started.

References

1. State Hazardous Materials Contingency Plan
2. 1991 Uniform Building Code
3. Superfund Amendments and Reauthorization Act of 1986
4. Title 42 of U.S. Government Code, Section 11001 *et seq.*
5. California Health and Safety Code, Chapter 6.95
6. Title 19 of California Code of Regulations
7. National Fire Protection Association, *Loma Prieta Earthquake Emergency Response and Stabilization Study*
8. Association of Bay Area Governments, *Hazardous Materials Problems During Earthquakes: A Guide to Their Cause and Mitigation*
9. Association of Bay Area Governments, *Manual of Techniques for Preventing or Controlling Toxic Gas Releases in Earthquakes* (Draft), June 1991

Initiative 3.9**Improve Earthquake Performance of Telephone Systems**

Following earthquakes, a flood of essential and nonessential calls overload telephone systems. Although performance of telephone equipment and facilities was acceptable in the Whittier Narrows and Loma Prieta earthquakes, partly because of retrofitting programs, the heavy volume of calls still disrupted essential services telephone systems. The near failure of a critical telephone building in Oakland during the Loma Prieta earthquake confirmed the possibility of even more expensive and disruptive failures of communication systems.

Cellular telephones are an emergency communication alternative that served emergency responders following the Loma Prieta earthquake and smaller disasters since then. Mobile and transportable phones make communication from disaster scenes possible. But they can become saturated during an emergency unless a priority setting mechanism is set up by federal regulators.

System management techniques can address overloading of these systems. For example, systems can give essential phone calls priority, limit the length of nonessential calls, and provide a "voice mail system" out of the damaged area. The Federal Communications Commission is investigating a Telecommunications Service Priority system that would help restore service after a disaster.

Objective

By December 1996, the Public Utilities Commission improves telephone systems' ability to withstand earthquake forces, maintain essential communication capabilities, and improve overall communications using enhanced disaster procedures.

Milestones

1. By January 1992, the Office of the State Architect will establish a cellular telephone task force to develop regulations and standards to ensure the maintenance of cellular telephone service during and after earthquakes.

2. By January 1994, the Seismic Safety Commission, with other responsible agencies, proposes legislation authorizing utilities to implement procedures that mitigate overloads and ensure access for essential communications.
3. By January 1995, the Seismic Safety Commission, with other responsible agencies, proposes legislation to establish a hazard mitigation plan for essential communication systems.
4. By December 1996, and annually thereafter, the responsible agencies report to the Public Utilities Commission on the progress of the above mitigation program.

Resources Needed

State: Additional administrative costs required by this initiative should be absorbed by the agencies involved.

Responsible Agencies/Organizations

Public Utilities Commission (Richard Smith, Telephone Communications)
 Private telephone and cellular utilities
 Seismic Safety Commission (J.F. Goodfellow)
 Office of Emergency Services (Mike Guerin, Assistant Director, Response and Recovery)
 Department of General Services, Division of Telecommunications (Fred Guston, Deputy Director)
 Office of the State Architect, Essential Services Act Advisory Board (H. Patrick Campbell, Chief Structural Engineer)

Status

1991 legislation requires a task force of the Seismic Safety Commission to develop performance standards for cellular systems.

References

1. Department of General Services, 9-1-1 Disaster Preparedness Report, 1991
2. Federal Emergency Management Agency and National Institute of Standards and Technology, A plan to develop lifeline earthquake engineering standards
3. Federal Communications Commission Telecommunications Service Priority System
4. Chapter 813, Statutes of 1991

Category 4

Disaster Recovery

Predisaster recovery planning is as much mitigation planning as is structural retrofit planning for buildings. The longer recovery from a damaging earthquake takes, the greater its human and economic toll. The major responsibility for managing post-earthquake recovery and reconstruction belongs to local governments and the private sector. This responsibility can be an overwhelming but should not be unanticipated. An earthquake's impact on the community changes policy agendas and governing priorities for at least several years, and local decisions are often constrained by the limitations imposed by federal and state disaster assistance programs. But these problems can be reduced through advance planning.

The longer-term and more difficult governmental issues that emerge once the initial emergency response period is over—economic development, land use, housing, redevelopment and building standards—are similar to many with which local officials deal regularly; however, the environment in which they must address them changes radically. Public safety concerns and business pressures for a quick return to “normal” compress the time frames for making decisions. Yet, with predisaster planning and organizing, the systems needed to make the recovery process work can be coordinated.

Like the first five-year program, this second five-year program emphasizes the need for preevent earthquake recovery planning by local jurisdictions, state agencies and university systems. Experience shows that communities that consider these problems in advance suffer far less economic and social disruption in an earthquake's aftermath. Effective recovery planning is essential to expedite reconstruction, and is especially important to reassure the business community so it continues to provide goods and services—and jobs. State and federal aid can help, but only the community itself can do the planning, provide the help, and establish the climate that encourages community and business recovery. Moreover, through

advance planning a community can gain a better understanding of the need to reduce hazards and develop a recovery framework that includes community leaders in business, housing, and social services and neighboring jurisdictions.

There are three important aids to assist local jurisdictions in preevent planning for post-disaster recovery and reconstruction.

- *The Disaster Recovery and Reconstruction Act of 1986* authorizes local governments to do advance recovery and reconstruction planning and allows for the creation of “standby” local reconstruction authorities.
- *Preearthquake Planning for Post-earthquake Rebuilding* (PEPPER) (William E. Spangle, Ed.), funded by the National Science Foundation, examines the many elements affecting the feasibility and nature of the whole planning process for rebuilding.
- *Recovery and Reconstruction Planning Guidelines for Local Governments*, recently published by the Southern California Earthquake Preparedness Project (SCEPP), is the culmination of a multiyear effort drawing on expertise from both public and private sectors, including officials directly involved in recovering from the Whittier Narrows and Loma Prieta earthquakes. The guidelines address critical issues such as rehabilitation and rebuilding, local business recovery, housing displaced persons and families, public facilities and services, and recovery financing.

The state, of course, has a major stake in earthquake recovery. It is responsible for its own buildings and programs and for furnishing and administering disaster aid and a host of other programs such as workers compensation that aid earthquake victims. The state must work to improve coordination and efficiency of existing aid programs that assist local governments, businesses, and citizens to recover from earthquakes.

Not enough is known about the effects of a major earthquake on California's state government and economy to predict effects with any precision, but it is clear that they will be severe, and it is also clear that state government must plan for its own recovery

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from such an earthquake—repair of infrastructure and its own buildings, and disruption of its operations. The Commission's report *Policy on Acceptable Levels of Earthquake Risk in State Buildings* (SSC 91-1) recommends steps that each agency should take to manage its earthquake risk and includes a timeline that would meet the Legislature's goal of reducing California's earthquake risks significantly by the year 2000.

The objectives of the initiatives in this category are to:

- Encourage California cities and counties to prepare and update plans for

community recovery and reconstruction after a major earthquake.

- Determine how local, state and federal governments will be affected by a major earthquake to mitigate effects to the extent possible and manage the remaining problems.
- Develop a practical program to preserve unique historic and architectural resources damaged in an earthquake.
- Improve state and federal disaster assistance and its delivery.
- Develop options for replacing housing, especially low-cost housing.

Initiative 4.1

Implement Recovery Guidelines

Experience with damaging earthquakes in California clearly demonstrates the difference between recovery and economic impacts from local seismic events that recur frequently and the infrequent regional disasters for which impacts continue for years. During the first five-year program, several basic tools were developed to help local governments plan for post-earthquake recovery and reconstruction. Improved use of this recovery guidance and its implementation must be encouraged since competing demands for limited government resources continue to delay recovery planning for future disasters.

Objective

By January 2000, local jurisdictions complete planning actions to make recovery from natural disasters more effective and timely.

Milestone

1. By December 1993, the Bay Area Regional Earthquake Preparedness Project completes a resource manual to help jurisdictions recover from earthquakes.
2. By December 1994, the Office of Emergency Services, using the Bay Area Regional Earthquake Preparedness Project and the Southern California Earthquake Preparedness Project, initiates workshops to train local government officials in recovery planning.
3. By December 1994, the Office of Emergency Services determines potential mutual aid needs to help local jurisdictions recover.
4. By December 1994, the Office of Emergency Services develops a recovery and reconstruction planning module and includes it in training programs given at the California State Training Institute.

Resources Needed

State: \$125,000 per year for three years (\$375,000 total) for the Office of Emergency

Services to develop training materials and present workshops.

Local: Unknown.

Responsible Agencies

Office of Emergency Services (Cindy Shamrock, Chief Deputy Director, and Paul Flores, Deputy Director)
 Bay Area Regional Earthquake Preparedness Project (Richard Eisner, Director)
 Southern California Earthquake Preparedness Project (Gilbert Najera, Director)
 Economic Development Commission (Debbie McConville, Deputy Director)
 Seismic Safety Commission (J. F. Goodfellow, Planner)
 State Historical Building Safety Board (Jud Boies, Executive Officer)
 County Supervisors Association of California
 League of California Cities
 Community Redevelopment Agencies Association

Status

The recovery guidelines developed by the Southern California Earthquake Preparedness Project can serve as a basis for this effort.

References

1. Government Code Section 8874.5 *et seq.*
2. US General Accounting Office, *Disaster Assistance*, March 1991
3. National Science Foundation, *Preearthquake Planning for Post-earthquake Rebuilding*
4. Office of Emergency Services, *Earthquake Recovery and Reconstruction, Planning Guidelines for Local Governments*, May 1991
5. Governor's Emergency Task Force on Earthquake Preparedness, *Long Range Recovery and Reconstruction*, August 1981
6. City of Los Angeles, *Draft Recovery and Reconstruction Plan*, May 1991
7. Stanford University, *Earthquake Risk Management Commission: Final Report*, October 1990
8. Public Law 100-707, The Stafford Act

Initiative 4.2

Initiate a State Recovery Plan

Two years after the Loma Prieta earthquake, recovery still has far to go. Many major state agency highway and building reconstruction projects are barely started or have only been scheduled for future years. Agencies affected by building closures had to relocate and reestablish operations during a period when their services were needed. A variety of impediments to timely, effective recovery are apparent. These include the lack of plans to resume providing state services and practical decision making mechanisms to deal with damaged buildings and bridges. State government itself must begin planning for its own business resumption, recovery and reconstruction. State agencies must identify buildings and facilities likely to be damaged by earthquakes and adopts plans to guide the restoration of services after major earthquakes.

Objective

By January 2000, all state agencies and institutions that has facilities at risk in earthquakes adopt business resumption and recovery plans.

Milestones

1. By December 1993, the Seismic Safety Commission designs a briefing or series of briefings on California's earthquake risk, risk management, and the value of planning for earthquake recovery by each state agency.
2. By December 1994, the Seismic Safety Commission arranges for this briefing or series of briefings to be presented to senior Administration and budget officials.
3. By July 1995, the Administration assigns a control agency to oversee agency recovery planning.

Resources Needed

State: The plan can be developed without additional funding.

Responsible Agencies

Seismic Safety Commission (Brian Stoner, Legislative Liaison)
Department of General Services
Department of Finance
Office of Emergency Services (Cindy Shamrock, Chief Deputy Director)
University of California, Office of the President
California State University System, Office of the Chancellor

Status

To be started.

References

1. Seismic Safety Commission Report, *Policy On Acceptable Levels of Earthquake Risk In State Buildings*, SSC 91-01, 1991
2. Seismic Safety Commission Report, *Report to Governor George Deukmejian on Executive Order D-86-90*, SSC 90-06, 1990
3. Governor's Emergency Task Force on Earthquake Preparedness, *Long Range Recovery and Reconstruction*, August 1981
4. Southern California Earthquake Preparedness Project, *Earthquake Recovery and Reconstruction, Planning Guidelines for Local Governments*, May 1991
5. Stanford University Earthquake Risk Management Commission: *Final Report*, October 1990
6. City of Los Angeles, *Draft Recovery and Reconstruction Plan*, May 1991

Initiative 4.3

Estimate Economic and Governmental Impacts

When a major earthquake occurs in one of California's urban areas, it may cause great loss of life and will cause immense damage to the economy of the affected region and the entire state. Businesses and individuals will be severely affected; local and state governments will be hard pressed to deliver normal services, let alone the disaster aid the stricken area will require.

Although the Loma Prieta earthquake epicenter was in a rural area, it reduced property tax assessments by \$465 million, which in turn decreased the property tax revenues of nine counties by \$4.7 million annually. Sales taxes and other government revenues were also affected. A major urban-area earthquake will cause economic losses and reduce tax revenues and productivity, and increase costs for disaster aid and recovery funding, repair of government and private facilities, and resumption of government operations. State and local governments, businesses, and individuals need to prepare appropriate precautions and adopt suitable management strategies to deal with the financial aftermath of such an earthquake.

A study is needed to identify the range and types of losses and the probable consequences of such an earthquake on the economies of the state's major urban areas and resulting impacts on state and local government operations. It should make recommendations for avoiding, ameliorating, and recovering from them to provide a basis for state and local government, businesses, and individuals to develop plans and strategies to reduce earthquake impacts.

Objective

By December 1995, the Seismic Safety Commission makes available to local and state governments a study that focuses upon the probable economic consequences of a major urban earthquake and identifies and recommends appropriate strategies and policy options for local and state governments.

Milestones

1. By December 1993, the Seismic Safety Commission convenes an advisory committee to describe the scope of the study and procedures for implementing it.
2. By July 1994, the Seismic Safety Commission submits the final study, including policy recommendations, to the Governor and the Legislature, and distributes copies to local government agencies.
3. By January 1996, the Seismic Safety Commission sponsors legislation needed to implement the study's recommendations.

Resources Needed

State: \$250,000 for study

Responsible Agencies

Seismic Safety Commission (Brian Stoner, Legislative Liaison)

Department of Finance

Business, Transportation and Housing Agency

Department of Insurance (name, position)

Office of Emergency Services (Cindy Shamrock, Chief Deputy Director)

Status

1991 Legislation (SB 231, Alquist) is pending.

References

1. Governor's Emergency Task Force on Earthquake Preparedness, *Long Range Recovery and Reconstruction*, August 1981
2. The Earthquake Project, *Catastrophic Earthquakes: The Need to Insure Against Economic Disaster*, March 1989

Initiative 4.4

Develop Rubble Disposal Strategy

Major earthquakes produce large amounts of debris from damaged structures. Many different methods are available for disposal. In San Francisco, after the 1906 earthquake, much of the rubble was pushed into the bay; some, unfortunately, became the uncompacted fill on which the Marina District, which suffered heavy damage in the 1989 Loma Prieta earthquake, was built. Rubble from that earthquake in the City of Santa Cruz amounted to the equivalent of two years' worth of solid waste in the city's landfill.

Modern engineering practice considers loose, nonengineered fill to lack strength and stability for future construction, and recent environmental studies on water quality raise concerns that rubble could include hazardous materials and contaminate ground water and bays. There are limits on the type of rubble that can be recycled and few land fills are available for this use.

Recovery can be expedited, and engineering and environmental concerns reduced, by determining the most practical rubble disposal procedures prior to a major earthquake.

Objective

By December 1993, the San Francisco Bay Conservation and Development Commission prepares a model plan and implementation strategy for the removal and disposal of rubble after a future earthquake.

Milestones

1. By January 1992, the San Francisco Bay Conservation and Development Commission develops a coordinated multiagency feasibility study plan.
2. By December 1992, the San Francisco Bay Conservation and Development Commission presents results of the multiagency study and recommendations for action to the Seismic Safety Commission.
3. By December 1993, the Seismic Safety Commission incorporates the

recommendations into the California Earthquake Hazards Reduction Program.

4. By December 1994, the Seismic Safety Commission distributes to local governments a model plan and manual for removal, disposal and reuse of earthquake rubble.
5. By December 1996, the county governments develop strategies for the removal, disposal and reuse of rubble and incorporates these strategies in land use plans.

Resources Needed

State: San Francisco Bay Conservation and Development Commission will require 1/4 PY to complete these actions.

Responsible Agencies

San Francisco Bay Conservation and Development Commission (W. Travis, Deputy Director)

Seismic Safety Commission (Richard McCarthy, Geologist)

US Army Corps of Engineers (Hugh Converse, Engineer)

Status

Funding and personnel are not available at this time. To be started.

References

1. California Coastal Act of 1976, California Government Code Section 3000 *et seq.*
2. McAteer Petris Act, California Government Code, Title 7.2

Initiative 4.5

Provide Post-Earthquake Housing

Replacing low-income housing after earthquakes is a significant recovery problem not adequately addressed by current programs. Even though the Loma Prieta earthquake was in a rural area, it damaged over 23,000 housing units in Santa Cruz, Alameda, and San Francisco counties. Nearly two years later, most still have not been replaced. Over 14,000 applications for temporary housing were approved. The situation will be worse after an urban area earthquake. A study of the effects of a great earthquake in southern California estimated that those made homeless could be as high as 130,000. Because of the type, age, and location of housing, a large share of these victims will be low-income persons.

The state's seismic retrofit programs administered by the Department of Housing and Community Development are focused on low-income, multifamily unreinforced masonry buildings, but funds are limited. Housing rehabilitation programs also have limited funding. Together these programs will not solve the problem caused by the vulnerability of the housing stock to earthquakes.

The problem is complicated because different agencies are responsible for long-term shelters, for temporary housing, and for hazard mitigation. Cooperation is needed to reduce housing losses and be ready to replace low-income housing that is damaged in future. Interim housing is a concern for agencies with both long-term sheltering and replacement housing responsibilities. The American Red Cross, local governments, Office of Emergency Services, Department of Housing and Community Development, Federal Emergency Management Agency and U.S. Housing and Urban Development Department all have significant responsibilities that need clarification.

Objective

By December 1996, the Department of Housing and Community Development develops an action plan and implementation strategy to retrofit or replace existing multiunit housing in buildings likely to fail and to provide for replacement housing after an earthquake.

Milestones

1. By July 1992, the Department of Housing and Community Development, with the

Office of Emergency Services, the Bay Area Regional Earthquake Preparedness Project, and the American Red Cross, assesses post-earthquake housing issues and identifies organizations that have responsibility for low-income housing retrofit as well as post-earthquake sheltering and replacement.

2. By December 1993, the Department of Housing and Community Development determines options, including possible financing mechanisms, for low-income housing retrofit and how to provide post-earthquake low-income housing.
3. By December 1995, the Department of Housing and Community Development and Office of Emergency Services recommend means for replacing low-income housing.
4. By December 1996, the Department of Housing and Community Development recommends procedures for more low-income housing retrofitting and financing.

Resources Needed

State: The activities should be done using existing resources.

Responsible Agencies

Department of Housing and Community Development (Dan Pennington, Chief, Division of Community Affairs)
Office of Emergency Services (Paul Flores, Deputy Director)
Association of Bay Area Governments (Gary Binger, Planning Director)
Federal Emergency Management Agency, Region IX (Nick Nikas, Disaster Response)
American Red Cross
League of California Cities
Seismic Safety Commission (J.F. Goodfellow)

Status

BAREPP is conducting a workshop on post-earthquake shelter and housing policy issues.

References

1. Seismic Safety Commission, *Loma Prieta's Call to Action*, SSC 91-06, June 28, 1991
2. Association of Bay Area Governments, *Blueprint for Bay Area Housing*, May 1990

Category 5

Research and Information/ Education

The tremendous risk to life and property in California provides a powerful incentive to press ahead in filling the gaps in knowledge of earthquake causation, seismicity, resistant structural design, hazard mitigation, and in social, behavioral, and policy issues. Earthquake safety progress in California depends on our ability to learn more about earthquakes and to apply that knowledge more effectively. This requires a comprehensive research program that is focused on the state's most critical seismic safety needs. A coordinated public information/education program is required to make sure that California's citizens can act to reduce their own earthquake risks, and will support needed programs at both the state and local levels.

Research

Research is essential to understanding earthquake hazards and finding ways to mitigate them. Research is an important component of many initiatives in this five-year program, especially in the areas of engineering, architecture and earth sciences. Equally important is translation of research results into a form that will be used. Transfer of this new knowledge is necessary to reduce earthquake hazards and improve seismic policy, and to make these results available to all who need them. Emerging technologies must also be explored because of their potential contribution in reducing costs and increasing effectiveness of earthquake safety.

Greater understanding of the causes and effects of earthquakes will assist public and private entities in carrying out their seismic safety responsibilities. A comprehensive program of research will find reliable and cost-effective strategies for dealing with existing hazardous structures, design safer buildings, make better land-use decisions, and conduct better emergency response operations. Research results can find ways to encourage individuals and businesses to plan for earthquakes, establish economical recovery strategies, and improve recovery

planning and operations. Research can advise persons how to avoid injury during earthquakes and medical professionals how to better prepare for and respond to those who are injured.

This objectives of the initiatives in this category are to:

- Learn how to achieve defined levels of earthquake performance in facilities and engineered structures.
- Find economical means to reduce earthquake losses.
- Learn how to maintain or rapidly restore the function of infrastructure systems during and after earthquakes.
- Learn how to make earthquake emergency response more effective.
- Learn how to rapidly restore damaged communities following an earthquake.
- Improve the use of knowledge gained through research and experience.
- Develop methods to motivate people of varied cultural backgrounds to prepare for earthquakes, and to communicate response and recovery information to them.
- Provide adequate facilities for research and development and to validate engineering practices and proof-test earthquake mitigation devices.

Information/Education

Public information and education are critical to successful implementation of hazard reduction plans. Individuals, businesses, and private organizations are responsible for their own hazard mitigation actions. No one else—not the state government, the federal government, or local governments—can do it for them. But these individuals and organizations will act only if they know how to take reasonable precautions to reduce hazards, to respond to emergencies, and to recover more easily. Education that leads to this understanding of the earthquake risk can provide the basis for public and political support for expensive actions necessary to prepare for earthquakes.

Providing information to the media is of particular importance. State and local government agencies have a special responsibility to provide accurate, helpful

information that can be given out by the media after a damaging earthquake. Emergency response organizations need to stress development of an ongoing media relationship to develop an understanding of news organizations' disaster response problems and parameters.

Because so much information must be shared by so many organizations, a coordinated program is needed to focus on providing high-priority messages to those who need and can best use it. This would involve state agencies such as the Office of Emergency Services, the Southern California Earthquake Preparedness Project, the Bay Area Regional Earthquake Preparedness Project, the Department of Conservation, and the Seismic Safety Commission; volunteer organizations such as the Red Cross, the Salvation Army, and the United Way; federal agencies such as the Federal Emergency Management Agency and the U.S. Geological Survey; and

private businesses such as Pacific Bell, which publishes earthquake information in the front of their telephone books. These organizations should decide who needs earthquake information, what information is needed, how it should be delivered, and how it should be paid for.

Objectives

- Obtain the information needed to reduce losses from future earthquakes by carrying out an earthquake research plan that focuses limited earthquake research resources on priorities based on seismic safety needs.
- Assure the information reaches businesses, private and public organizations, and individuals of varied cultural backgrounds in a media and form that will help them take appropriate actions before, during and after earthquakes to reduce deaths, injuries, and disruption.

Initiative 5.1

Implement An Earthquake Research Plan

Reducing California's seismic hazards significantly by the year 2000, and setting the stage for continued progress afterward, requires a coordinated research effort in engineering and architecture, earth sciences, and social sciences and public policy. Needed are a strengthened understanding of the nature, causes and prediction of earthquakes; better ways to mitigate structural and geotechnical hazards; improved understanding of social and economic impacts of earthquakes, and methods of reducing adverse effects; and better strategies and policies for emergency response and recovery. In addition, the development and implementation of new technologies should be encouraged wherever they hold promise of helping with seismic hazard reduction.

To accomplish this goal, the Seismic Safety Commission must develop a five-year Earthquake Research Plan for the State of California, and work in cooperation with both researchers and practitioner-users to implement the plan and put the research to work in reducing earthquake hazards. The Earthquake Evaluation Conference required by SB 1835 (Chapter 782, Statutes of 1990) will help develop a strategy for earthquake research, with particular attention to investigations likely to bring about a significant reduction in loss of life and property damage, and to promote more rapid economic recovery from earthquakes. The findings of the Earthquake Research Evaluation Conference will be incorporated in the plan.

Objective

By **December 1992**, the Seismic Safety Commission adopts an Earthquake Research Plan that: (1) enables the state to coordinate, identify and fund priority earthquake research to best meet the state's seismic safety needs; (2) identifies for federal, state, and local governments and private industry those areas of earthquake research where outside funding assistance is most needed; and (3) assists in review of research proposals.

Milestones

1. By **April 1992**, the Seismic Safety Commission reviews and adopts a "Draft Earthquake Research Plan."
2. By **September 1992**, the Seismic Safety Commission, in collaboration with the California Council on Science and Technology, the Division of Mines and Geology, and the Office of Competitive Technology, holds an Earthquake Research Evaluation Conference. Participants in this conference will review, critique, and revise the draft research plan prepared by the Seismic Safety Commission.
3. By **December 1992**, the Seismic Safety Commission adopts a final Earthquake Research Plan and begins efforts to seek funding, through legislation and/or other means, to carry out the plan.

Resources Needed

State: The Seismic Safety Commission will absorb the cost of preparing the plan and will seek \$25,000 for the evaluation conference. Research funding needs will be included in the plan.

Responsible Agencies

Seismic Safety Commission (Richard McCarthy, Geologist)
Division of Mines and Geology (James F. Davis, State Geologist)
California Council on Science and Technology (Dr. Donald Shields, Executive Director)
Office of Competitive Technology (Max Cheeseman, Contracts and Grants Manager)
California Universities for research in earthquake engineering
University researchers in earth sciences
Research Universities; Federal Agencies; Private Industry; Local Government

Status

Preparation of the Earthquake Research Plan and the Earthquake Evaluation Conference is underway.

References

1. Chapter 782, Statutes of 1990
2. Chapter 901, Statutes of 1991

Initiative 5.2**Establish a Coordinated Earthquake Information Strategy**

Information on seismic risk, hazard mitigation, emergency preparations and response and recovery are at present provided by a variety of federal, state, and private organizations. Not all the information provided is accurate, or meets public and business needs. A particular need is to ensure that the media are prepared and equipped to give the public the information it needs immediately following earthquakes regarding how to deal with injuries, damage and debris; likelihood of aftershocks; and the status of services, transportation, etc.

Objective

By December 1994, responsible agencies identified through a Memorandum of Understanding will create a strategic plan for a unified public information campaign for state agencies and other cooperating organizations, and a process to develop and approve materials that are accurate, up to date, and consistent among organizations.

Milestones

1. By July 1992, prepare a Memorandum of Understanding among Office of Emergency Services, Division of Mines and Geology, American Red Cross, USGS, Federal Emergency Management Agency, and the Seismic Safety Commission to cooperate in developing a plan and materials.
2. By December 1992, the agencies who are parties to the Memorandum of Understanding develop a strategic plan regarding what messages and risk communication techniques are appropriate to specific audiences, who will develop materials, and how the audience will be reached.
3. By December 1993, the agencies who are parties to the Memorandum of Understanding review existing and draft materials for accuracy and consistency.
4. Annually review the strategic plan and status of the program.

Resources Needed

The resources needed to agree on this process can be absorbed by the cooperating agencies.

Responsible Agencies

Seismic Safety Commission (L. Thomas Tobin, Executive Director)
Office of Emergency Services (Tom Mullins, Public Information Officer)
Office of State Architect (Larry D. Guthrie, Chief, Seismic Program Section)
Division of Mines and Geology (James F. Davis, State Geologist)
Federal Emergency Management Agency, Region IX (Nick Nikas, Disaster Response)
US Geological Survey (name, position)
American Red Cross (Peggy Brutsche, Education Coordinator)
Structural Engineers Association of California
Pacific Bell (Steven Sem, Customer Guide Manager)

Status

Public information programs are already underway.

Initiative 5.3

Identify and Reduce Tsunami Hazards

Tsunami, waves caused by earthquake-induced movements of the ocean floor, can strike development along the California coast with devastating force. Although tsunami can be created by large earthquakes anywhere in the Pacific, the most likely sources that affect California are along the Aleutian trench in Alaska or off South America. In addition, sudden offsets of the sea floor by thrust faults in offshore California can create damaging waves by moving the sea floor or causing submarine landslides. A tsunami caused by the 1964 Alaskan earthquake struck Crescent City killing 11 and causing about \$7 million in property damage. Since 1964, extensive development has occurred along the California coast and is continuing.

California is not prepared for the tsunami hazard. In other parts of the world, land use planning, construction techniques, physical barriers, evacuation plans, and warning systems are used to mitigate this hazard. California has not considered this problem or its mitigation policies for nearly two decades. Improved understanding of the seismology of the Pacific Rim, local offshore geology, the movement of waves across the ocean and near shore, and the effect of waves striking a coastline make it easier to understand and plan for California's exposure.

Objective

By December 1994, the Seismic Safety Commission and other responsible state and federal agencies shall assess the risk of tsunami to the California coast and propose a hazard reduction program.

Milestones

1. By July 1993, the Seismic Safety Commission, with the National Ocean and Atmospheric Administration and the Office of Emergency Services, gather experts in seismology, oceanography, coastal engineering and geology, land use, coastal and emergency planning, and public policy to reevaluate California's tsunami hazard and recommend additional work.

2. By January 1995, the Commission and other responsible state and federal agencies publishes a background report and recommends legislation to reduce tsunami hazards.

Resources Needed

State: The Seismic Safety Commission will need 1/2 PY to plan and about \$100,000 for invited papers and the meetings.

Federal: Federal agencies including the National Ocean and Atmospheric Administration, U.S. Geological Survey and the U.S. Army Corps of Engineers should absorb the cost of participating.

Responsible Agencies

Seismic Safety Commission (Richard McCarthy)
Office of Emergency Services (Ilene Baumgardner, Assistant Director, Plans)
California Coastal Commission (Peter Douglas, Executive Director)
Department of Conservation, Division of Mines and Geology (Michael Richle, Geologist)
National Ocean and Atmospheric Administration (Curt Mason, Physical Oceanographer)
U.S. Army Corps of Engineers (George Domurat, Oceanographer and Mark Verke, Chief, Emergency Management Division, Sacramento District)
Federal Emergency Management Agency, Region IX (Nick Nikas, Disaster Response)
U.S. Geological Survey (D.S. McCulloch, Geologist)
California Department of Boating and Waterways (Reinhart Flick, Oceanographer)

Status

To be started.

References

1. National Oceanic and Atmospheric Administration, *United States Tsunami's*, 1690-1988, Pub. 41-2, 1989
2. U.S. Army Corps of Engineers, Waterway Experiment Technical Report, *Tsunami Predictions for Pacific Coastal Communities*, H-74-3, J.R. Houston and A.W. Garcia, 1974, Type 16 Flood Insurance Study
3. California Coastal Act of 1976, Government Code Section 3000 *et seq.*

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Hence adherence to seismic safety principles is inconsistent and in many cases unverifiable.

In its report on acceptable levels of risk in state-owned buildings submitted for the Legislature's consideration in January 1991, the Commission proposed that it be made clear who is responsible for each of the state's buildings, and that adequacy of earthquake resistance be considered to the same degree as adequacy of other building characteristics. The report recommended that steps be taken to reduce the vulnerability and make plans to cope with anticipated damage, but these recommendations have not yet been considered. Recommendations to improve state agency design and construction practices have not been adopted, and the state's practices regarding new construction seldom follow the basic principles suggested.

The DGS Division of State Architect (DSA) provides regulatory services only for DGS buildings and on request of other agencies. However, DSA lacks the authority of a true building department to issue permits or stop work. Executive Order D-86-90 orders all state agencies to submit their designs to DSA, but they have not been doing so. Moreover, buildings designed and constructed for state lease with option to purchase are reviewed by local building departments rather than DSA. In August 1991, DSA submitted proposed changes to the State Administrative Manual to

require plan checking and inspection procedures for exempt departments and projects, but these changes have not yet been approved and issued.

Although the general program framework for a building department now exists at DSA, the additional workload that will be generated by this requirement may be too much for the present staff to handle. Rather than increase staff size, it is recommended that DSA contract for plan-checking services to expedite the process while still providing an appropriate level of review for state building projects. Exempt state departments should also use DSA as a "consultant" within the existing plan review system. Regardless of the method used to accomplish structural plan checking, state departments should include plan-checking fees based on estimated contract costs in their project budgets.

Continuing Education (2.5)

There is an urgent need to provide continuing education to keep the professionals practicing in the rapidly advancing field of seismic design and construction up to date. Efforts to seek legislation that requires continuing education have failed; therefore, additional work is needed with the appropriate professional organizations to determine how it can be provided.

Emergency Response Management

California's emergency response planning, capability, and training have improved markedly since 1991 when this *California at Risk* program was developed. Experience from earthquakes, toxic spills, and wildfires have tested emergency response plans time and again, providing on-the-job training and leading to significant improvements. Yet, because of the continued vulnerability of so many buildings and lifelines and the possibility of widespread earthquake damage, our state and local emergency response systems could be overwhelmed. More needs to be done.

The advances in communications capability, standardization of emergency management systems, and expansion of mutual aid arrangements, along with a comprehensive reorganization of the Governor's Office of Emergency Services (OES), greatly improve the ability of state and local agencies to respond when an urban earthquake strikes. Moreover,

the Earthquake Safety in Public Buildings Bond Act (Proposition 122), which is being implemented by the Division of State Architect, will provide matching grants to cities and counties to improve the seismic performance of structures needed for emergency response and communications. Response 95, an exercise designed to test the state and federal emergency management systems that is planned for the spring of 1995 if sufficient funding is available, will improve the state's ability to manage a catastrophic disaster and lead to improvements in the system.

Local government is the backbone of the first response to any disaster, but it is weaker now than two years ago. Budget cuts have reduced the number and level of emergency managers and undermined their training and planning efforts.

- Many local jurisdictions have transferred emergency management responsibilities

from city and county administrative offices to fire or sheriff's departments. The critically important job of planning, coordinating, and exercising all local government departments is becoming just one more job for already busy line officers.

- Few jurisdictions have the funds to supply up-to-date equipment to fire, police, emergency medical aid, and public works units. For example, despite the critical role that communications play in disasters and the capabilities of modern communications technology, radios in current use too often do not allow communications between police and fire departments or with personnel from adjoining jurisdictions. In some cases, units from different districts within the same jurisdiction cannot communicate directly.

An acceptable emergency response to infrequent large-consequence disasters requires a continued investment in planning, training, exercises, information databases, and equipment.

Continued improvements in instrumentation and computational ability have created new and faster sources of disaster information. For example, the California Institute of Technology/US Geologic Survey Broadcast Earthquakes (CUBE) System for southern California now provides data on earthquake magnitude and location via a commercial paging system within minutes of a shock; a similar system is being developed by the US Geologic Survey, the Pacific Gas & Electric Company, and the University of California-Berkeley as the Broadcast of Earthquake Notification Information for northern California. Government and private-sector organizations could use this information to guide initial response decisions, but few government agencies can afford the cost of a subscription.

Emergency Communications (3.1)

The objective of this initiative will be met during 1994, two years ahead of schedule. Since 1991 OES has implemented a satellite-based emergency communications system (OASIS) that now has terminals installed in 34 counties. When it is completed in July 1994 there will be terminals in all 58 counties and in offices of the City of Los Angeles, Caltrans, OES, the Department of General Services, the California Institute of Technology, and the US Geologic Survey. Participation in the system has also been offered to major communica-

tions, oil, and gas utilities if they purchase their own hardware.

The initiative also pointed to the need to improve emergency communications with utility companies and emergency medical service providers. The Department of General Services will amend the State Telecommunications Plan in 1994 to incorporate these changes.

Each utility has emergency plans and has participated in exercises testing radio systems, and the major utility companies intend to locate their representatives in the State Operations Center in Sacramento after an earthquake. This system was used after the Northridge earthquake of January 17, 1994 and proved very effective in coordinating emergency response and speeding resumption of services.

The mode of communication to be used if landline and cellular service is interrupted varies by company: Southern California Edison is developing a satellite-based system, the Southern California Gas Company and the Pacific Gas and Electric Company have dedicated high-frequency radio capability, and many of the other utilities rely on HAM radio operators. The Commission should seek to learn whether each of these companies has backup means of communication with the state in place.

Improved Emergency Management (3.2)

Legislation passed in 1992 (SB 1841) requires OES to create a Standardized Emergency Management System (SEMS) based on the use of operational areas, incident command system principles, and mutual aid. The implementing regulations have been drafted and reviewed, and will be adopted in early 1994. Training guidelines will be prepared by an existing training committee, and curriculum guidelines will be completed by the end of 1994. Current courses offered through OES's California Specialized Training Institute already reflect the new system, and existing state plans will be revised as necessary to incorporate the SEMS schedule. The objective of this initiative will be met in 1994, two years ahead of schedule.

OES is developing a new loss estimation computer program to estimate the type and extent of damage immediately after an earthquake. By anticipating the results of damage assessments, this program will accelerate delivery of statewide mutual aid and state and federal resources.

Mutual Aid (3.3)

The concept of mutual aid that has long been used by fire and law enforcement agencies when a jurisdiction's resources are overwhelmed has been extended to cover other services. Building inspectors now provide mutual aid, and the system also incorporates volunteer private-sector architects who provide building assessments after earthquakes.

In the Northridge earthquake of January 1994, the mutual aid concept was successfully expanded to include emergency managers. Emergency managers from throughout the state assisted the affected communities in emergency operations centers, disaster assistance centers, and county offices. They supplied a variety of services such as providing public information, writing hazard mitigation grant requests, and helping city councils deal with recovery issues.

During 1994 mutual aid will be expanded further to include emergency medical, mental health, water district, and urban search and rescue teams. Mutual aid for hazardous-materials spills will also be official in 1994. (Augmentation of some government functions, such as public works services, is not strictly mutual aid, but rather reimbursement for services.)

Standard procedures for using these services are being developed, and training has been offered or will be incorporated as part of the training associated with the new Standardized Emergency Management System described above.

The mutual aid system should eventually apply to all government functions, and local governments should be trained on how to access it.

Medical Mutual Aid (3.4)

The Emergency Medical Services Authority (EMSA), in conjunction with other state agencies including OES, the California National Guard, the Department of Health Services, local emergency medical services (EMS) agencies and health departments, and private and public prehospital and emergency medical care providers, continues to develop a statewide medical mutual aid system.

- Guidelines for procedures to acquire and mobilize medical resources (personnel and supplies) from unaffected areas have been developed. These resources may be acquired through county-to-county agreements, or

through the regional or state medical mutual aid system mediated by a Regional Disaster Medical/Health Coordinator or the State Disaster Medical Services Coordinator at EMSA.

- The Regional Medical Planner for OES's Southern Region has been actively working with private ambulance providers in that region to develop a mutual aid agreement. EMSA staff has discussed the possibility of using this as a model to develop similar agreements in the other OES regions with the California Ambulance Association's Disaster Committee and OES.
- A two-year project in Orange County has been funded to create a Hospital Emergency Incident Command System modeled after the Firescope Incident Command System. It is designed to assist medical facilities in coordinating their response with other agencies, and also helps hospital management to focus their efforts on the critical issues their facility may be facing as a result of the disaster. This project has also led to the development of a train-the-trainer module that is available for use anywhere in the state.
- Teams of medical personnel trained to respond as a unit after a catastrophic disaster can be far superior to the use of individual medical volunteers. The US Public Health Service (PHS) had established a Disaster Medical Assistance Team (DMAT) program as part of the National Disaster Medical System (NDMS), but there was no funding to promote team development. Beginning in 1992, EMSA made grant funding available through the Prevention 2000 Grant to provide such items as medical equipment and supplies, training, and exercise participation for teams that met development criteria. Prior to this program there were only two DMATs in California. Now there are eight, and another is being developed in northern California. NDMS has designated two of them as "Level One Readiness" teams that are eligible for medical equipment and supplies from the Federal Government, and can be among the first teams deployed in a disaster anywhere in the country. All eight California DMATs have agreed to respond at EMSA's request to a local or in-state disaster. EMSA has been working closely with PHS Region IX and the NDMS staff to develop procedures for access to federal medical equipment and supply resources and

DMATs from other parts of the country for California disasters.

- EMSA will eventually have the ability to communicate with emergency medical services in county emergency operations centers through OES's OASIS (Initiative 3.1). The California Amateur Radio Emergency Services (CARES), a group of skilled radio operators with stations in Sacramento, Berkeley, Fairfield, and Los Angeles, developed a backup system designed to communicate with an affected area for state Health and Welfare Agency departments. Many county EMS agencies have radio communications systems that include acute-care hospitals, ambulance providers, and EMSA.

The first milestone, to determine improvements in mutual aid and communications, has been met, albeit in an informal manner. EMSA has updated its own emergency plan as much as possible to include improvements. However, changes have not been made to the Medical Annex to the State Emergency Plan. In spite of the considerable progress, there remains a need for additional emphasis on medical mutual aid and incorporating the results into the appropriate state plans. OES can incorporate changes into the State Emergency Plan as the new procedures and systems are developed and adopted.

Emergency Medical Care Needs (3.5)

Estimating earthquake-caused casualties and the availability of medical facilities, resources, and personnel is critical to providing adequate care and treatment to earthquake victims. Information on the expected number and type of injuries has improved since the last estimates were made, but this information has not been used to make up-to-date estimates of demand. Hospital facilities built before 1973, and many or most clinics, may not be usable. The results of these studies and the resulting medical response strategy should be incorporated into the Medical Annex to the State Emergency Plan and other emergency planning.

One element of the "scenario" that OES is preparing to estimate and describe the possible effects of a major earthquake on the southern San Andreas fault will be an estimate of medical needs. However, work on the studies contemplated by this initiative have not begun, and completion will be delayed until 1996.

Shelter Planning (3.6)

The Loma Prieta and Whittier Narrows earthquakes showed the need to improve emergency and long-term shelter planning and operation. Shelters need to be identified in advance, and shelter managers need to be trained to work effectively with California's diverse population.

The Department of Social Services (DSS) has virtually completed this initiative in exemplary fashion.

- The state Welfare Emergency Services Team, consisting of state employees who have been trained as shelter managers, worked in food distribution and a variety of other roles during the 1993 floods in the Midwest, and senior personnel have worked extensively with the American Red Cross in planning and training as well as actual emergencies.
- Plans are progressing on developing a long-range plan for long-term sheltering that reflects the problems exposed by Hurricane Andrew.
- DSS will begin training county employees as shelter managers and welfare services providers during 1994.
- A statewide mutual aid system has been developed and the American Red Cross has enhanced its resources and delivery systems since 1991.

The objective of this initiative has been reached. There will be an opportunity during 1994 to update the State Emergency Plan to reflect this progress.

Professional Qualifications (3.7)

Emergency management has evolved into a specialized profession. Emergency managers exercise substantial responsibilities that profoundly affect the well-being of their communities. OES was expected to develop a professional qualifications program for emergency managers, but instead two other efforts have satisfied the need:

- The University of California has developed emergency management certificate programs at its Riverside, Irvine, and Berkeley campuses.
- The National Coordinating Council on Emergency Management (NCCEM), working with OES personnel, has developed a national certification program and has certified 211 people, out of over a thousand applicants nationwide, as meeting their standards. A California professional associa-

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tion such as the California Emergency Services Association could issue a California endorsement based on familiarity with California-specific topics.

OES is developing a cadre of disaster reservists, targeting local government employees who can augment state and local personnel. Reservists will be expected to meet a minimum standard. OES revisions to the State Emergency Plan could incorporate guidance on the qualifications desired for these reservists by recognizing these formal programs.

Hazardous Materials (3.8)

The release of toxic chemicals after an earthquake can have a critical influence on the seriousness of the emergency. Chemical releases will complicate emergency response efforts and could greatly endanger the public. The state and local governments have equipment, personnel, and procedures for responding to the frequent releases that occur for reasons other than earthquakes and, perhaps, even for moderately damaging earthquakes.

Many facilities that handle toxic chemicals are required to develop Risk Management and Prevention Programs (RMPP) that identify chemical hazards and the consequences of releases, as well as requiring planning to prevent releases of regulated chemicals. The RMPPs must analyze the effect of external events, including earthquakes, on the loss of regulated chemicals.

The RMPPs are administered at the local level of government, and many administering agencies have developed seismic guidance related to this analysis. Therefore, though state chemical accident-prevention programs address this issue, compliance is not consistent and enhanced program implementation would improve seismic safety.

Federal facilities have recently been directed by federal executive order to comply with state hazardous material laws, and a new federal Accidental Release Prevention Program is being developed by the federal Environmental Protection Agency that will establish requirements similar to the state RMPP and will improve chemical risk management and protec-

tion of public health and safety. It will be important to integrate the state and federal RMPPs to create a single efficient program.

OES and the State Fire Marshall are coordinating training for emergency responders that will improve response to chemical releases. This training should include specific elements on post-earthquake response.

The first milestone (recommend actions to improve seismic safety) is only partially done. Additional consideration is needed about how to prevent releases during earthquakes and how to cope with releases that occur during catastrophic earthquakes. However, the State Fire Marshall has completed Milestone 2.

Improve Telephone Systems (3.9)

Commercial telephone systems that are expected to provide communications after an earthquake may fail because of physical damage to buildings and equipment or from overloading. Redundancy provides some operational reliability, but systems remain vulnerable to damage although some progress has been made to improve essential communications, including reducing the number of nonessential calls. The communications systems carry out their own vulnerability assessments and have started programs to reduce that vulnerability, but a more rigorous and coordinated effort is needed to determine how reliable they will be following a major earthquake. Communications companies must also determine whether backup emergency communications equipment provides reliable means of communicating with the state and other utilities during an emergency.

The Emergency Cellular Communication Task Force created by AB 958 (Chapter 813, 1991) completed its work of reviewing cellular systems and made recommendations to satisfy Milestones 1 and 2. The authority to allow access restrictions to cellular systems after a disaster, a step necessary to allow essential communications, rests with the Federal Communications Commission, which has not responded to an Assembly resolution or a letter from the Commission asking them to address this matter.

Disaster Recovery

As with emergency response management, California's disaster recovery ability has benefited from experience in recent disasters. California is now better prepared to provide re-

covery aid to victims than it was just two years ago. However, earthquake recovery also includes restoring normal community services and economic vitality within an acceptable

length of time, and a casual review of recent recovery efforts indicates shortcomings in these areas:

- Recovery takes too long. The disruption to undamaged businesses and communities from the few damaged buildings in a community persists for years.
- The havoc created by failure of public and private infrastructure delays recovery and places new financial burdens on government.
- Endless disputes regarding the extent of repairs covered by federal programs delay public-sector repairs and confound individual victims.
- Earthquake insurance is carried by too few households and its deductible limits are often greater than the victim can afford.

Glaring weaknesses persist in private (insurance), state, and federal aid programs. Too often these programs fail to recognize that earthquake disasters are different from other disasters. Damage is often severe but may be hard to detect, or it may not be detected for several months, and it is expensive to repair to a standard that will reduce the chances of repeat damage. Federal disaster aid is primarily intended to repair damaged public facilities and roads, and to help individual victims make repairs; it is not aimed at making structures more earthquake resistant or speeding economic recovery. State business aid programs are very small, and federal small-business loan programs are too little and too late—the affected stores and plants need to get back into business immediately, to serve the community and provide jobs as well as for their own survival.

State government is not prepared to cope with the losses from a major urban earthquake that affects the state's economy and its own budget and cash flow. Relying on a post-disaster special session of the Legislature is not wise; lacking a clear public policy on disaster recovery makes it too difficult for the private sector and local governments to draw up their own disaster recovery and risk reduction programs. The state should define what programs will be needed to support economic recovery and how to raise the needed funds.

Recovery Guidelines (4.1)

Advance planning—or incredible good luck—is vital to rapid recovery from a damaging urban earthquake. Since jurisdictions that have thought through a recovery process or

have learned from previous disasters are generally better able to recover than those who have not, OES is considering recovery-period mutual aid and has arranged for jurisdictions with recent experience to work with those beginning to recover. OES has also completed a resource manual to help recovering jurisdictions, and OES's California Specialized Training Institute, which already has a recovery module and includes recovery information in its courses, will offer a new course on recovery.

The information resources and guidance are essentially in place; the burden now shifts to local governments to seek the training and begin their own recovery planning. OES should be commended for this effort.

State Recovery Planning (4.2)

The Loma Prieta earthquake surprised state agencies; most had never expected that their own buildings would be damaged beyond repair or that repairable buildings would still be closed four years later. Because even buildings that comply with code may be extensively damaged, the Commission has recommended a policy to the Legislature regarding acceptable levels of risk in state-owned buildings. Acceptable levels of performance would be set by each agency, depending on its mission and ability to deal with expected damage. Unfortunately, the Legislature has not acted on this policy.

Proposition 122, passed in June 1990, established a process to identify state-owned buildings that are likely to be damaged in an earthquake, but leased buildings can also be vulnerable. The state Office of Real Estate and Design Services has adopted a policy to lease only buildings that comply with modern seismic standards.

Because of budget cuts, the Commission has not provided contemplated briefings to state agencies and senior officials. This initiative must be delayed even though it need not be expensive or time consuming and would pay off several times over after an earthquake.

Economic and Governmental Impacts (4.3)

State government and the Los Angeles region will feel the economic impacts of the Northridge earthquake of January 17, 1994 for many years to come. Any such earthquake striking one of California's urban regions will cause immense physical damage and long-

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term economic problems. Local governments, businesses, and individuals will lose invested capital and face new debts with decreased income. The damage will have severe effects on both the regional and state economies, and the resulting social and economic disruption will last for years.

A study is needed to identify the range and types of losses that can be expected and the probable consequences of such an earthquake on the economy so that recommendations for avoiding, ameliorating, and recovering from them can be developed to assist state and local governments to prepare in advance. The state must contemplate how to raise the funds needed for recovery and develop programs that can be put into place to restart the economic engine of the damaged region. Because attempts to secure the funds needed for the study have not been successful, the Commission now plans to schedule hearings on this issue.

Rubble Disposal (4.4)

Earthquakes produce large amounts of debris from damaged structures, and communities need viable options for disposal and reuse within hours after the event. Landfill disposal, used after the 1906 earthquake, can create severe environmental and other effects that lead to long-term problems. To have better options outlined in advance can speed the work of removal, reduce costs, avoid environmental damage, and speed recovery.

The San Francisco Bay Conservation and Development Commission (BCDC), a state agency with a direct stake in finding a solution that does not threaten the bay, was to lead the effort to prepare a plan and make recommendations that could be used statewide. BCDC arranged for the California Policy Seminar, sponsored by the University of Califor-

nia, to hold a multiagency workshop on rubble disposal in February 1992 that successfully identified the relevant issues. However, since BCDC has not been able to obtain the funds to complete and publish the study, this initiative will probably be delayed until the next five-year *California at Risk* program, which begins in 1996.

Post-Earthquake Housing (4.5)

Although California housing is among the most earthquake resistant in the world, earthquakes will still damage large numbers of homes. Approximately 23,000 housing units were yellow tagged (limited entry) or red tagged (no entry) after the Northridge earthquake of January 1994. Estimates by the Association of Bay Area Governments indicate that over 50,000 units may be lost in a Hayward earthquake. Most homeowners don't have earthquake insurance and the California Residential Earthquake Recovery Fund, which would have assisted homeowners to repair their houses after an earthquake, was repealed in 1992. However, Assemblyman Areias has introduced a bill (AB 2613) to reestablish such a fund.

Older homes and multiunit housing are the most vulnerable. Replacing housing for low-income people is a major problem that has been actively considered by the state Department of Social Services, the American Red Cross, and OES. A report for OES by the University of California-Berkeley addresses post-earthquake housing issues and provides options. The effort is on schedule even though the responsible agency has changed; the Department of Housing and Community Development has not taken the lead as was anticipated two years ago.

Research and Information/Education**Research Plan (5.1)**

Even though much more information exists than is now put to use in the normal practice of geology, engineering, and other earthquake-related disciplines, there remain gaps in our knowledge that need to be filled to improve earthquake safety. Better knowledge will narrow uncertainty, minimize too-conservative as well as too-liberal assumptions and decisions, increase the reliability of our analytical methods, refine the selection of priorities,

and promote our understanding of the social and economic ramifications of earthquakes.

However, funds for research are severely limited: The preponderance of funding comes from the US Geological Survey and the National Science Foundation, both of which have a national—as opposed to a California—focus. They primarily support “unsolicited research” and fund only minimal knowledge-transfer efforts. The Commission’s draft comprehensive research plan seeks to direct exist-

ing funds to California's priority problems and to justify additional funding for inquiry planned to fill critical knowledge gaps. The plan will be complete by July 1994.

Research is needed, but putting knowledge to work in reducing risks throughout California needs much more attention. The progress made in the professions and by university researchers offers new, more certain, and often less expensive ways to reduce earthquake risk, but getting that knowledge into use by the thousands of practitioners in earth science, engineering, emergency response, and recovery remains a daunting challenge. The knowledge-transfer effort is severely lacking in resources needed to ensure that private-sector and local and state government officials and employees are reached. This effort relates to initiatives dealing with professional training, continuing education, and certification (2.3, 2.5, 3.7, and initiatives dealing with standards and plan development).

Information Strategy (5.2)

Informing and motivating Californians—individuals and leaders alike—to prepare for earthquakes is a challenge. Solid information, properly communicated, can motivate decisions to reduce risk before and during earthquakes, helping people avoid injury and minimizing damage. It would take only a modicum of risk reduction and training to help prevent the vast majority of Californians from becoming victims, alleviating many of the burdens on the emergency response and disaster recovery systems.

Effectiveness depends on creating well-designed and accurate information and delivering it repeatedly to strategically selected audiences through a variety of media. Unfortunately, state and local governments will always lack the budgets needed to carry on successful campaigns that can aim multiple messages at the numerous target groups statewide. Voluntary social service organizations and the news media are willing and eager partners, but current efforts must make do with limited budgets and take advantage of opportunities as they arise.

Information management and transfer are changing rapidly with new computer and other communication systems. Computer databases and bulletin boards should be considered as adjuncts to the traditional resource center.

Efforts to develop cooperation, decide on long-term strategies, and revise or prepare literature are lagging because of other priorities.

Tsunami Hazard (5.3)

Tsunami are large waves caused by suboceanic earthquakes and massive submarine slumps. California is exposed to tsunami, but little has been done to identify the extent of the hazard or adopt appropriate risk-reduction measures. The tsunami following the 1964 Alaskan earthquake caused significant damage in Crescent City, and recent estimates indicate that an offshore earthquake in the Eureka area could cause significant runups.

Clearly the probability of damage from tsunami is less than that from ground shaking and soil failure, but the potential for loss of life justifies additional inquiry. Two Commission hearings have helped to identify the threat, its damage potential, and mitigating actions, and the National Oceanic and Atmospheric Administration has included identifying and mapping tsunami runup areas in California in its long-term plan.

Category 3—Emergency Management and Response

Bill No.	Author	Description	Status
AB 402	Roybal-Allard	Provides for licensure exemptions for out of state medical health professionals during a disaster.	Chaptered 89-97
AB 697	Roybal-Allard	Designates the Department of Education as the lead agency for the development and coordination of plans and procedures for earthquake awareness, disaster plans, and hazard reduction programs for public schools.	Chaptered 89-643
AB 779	Eastin	Creates a State Emergency Response Team that focuses upon the recovery of state operations following a disaster.	Chaptered 90-1210
AB 957	Areias	Requires the Office of Emergency Services to develop model disaster registry guidelines for use by local government agencies and organizations.	Chaptered 91-0366
AB 1390	Kelley	Allows the Emergency Medical Services Authority and the Director of Health Services to establish a regional disaster medical and health coordinator.	Chaptered 89-185
AB 1791	Becerra	Establishes the California Disaster Response and Recovery Training Program to develop emergency management model plans for urban and rural school districts.	Vetoed, 1991
AB 1966	Areias	Allows the Governor to temporarily suspend orders, rules, regulations, statutes or nonsafety restrictions on the delivery of food products, pharmaceuticals or other needed emergency supplies during a state of emergency.	Chaptered 91-1186
AB 1967	Areias	Requires the Office of Emergency Services to develop evacuation guidelines for the University of California and the State University campuses to use in the development of emergency evacuation plans for student housing.	Chaptered 91-645
AB 2704	Speier	Requires the Office of Emergency Services to conduct a study to determine if there is a need for the expansion of existing local governmental emergency operation centers.	Vetoed
AB 2840	Woodruff	Requires the Office of Emergency Services to reimburse disaster search dog handlers for their travel costs to state training facilities.	Chaptered 90-894

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Category 3—Emergency Management and Response (continued)

Bill No.	Author	Description	Status
AB 2962	Klehs	Requires the Office of Emergency Services and the Department of General Services to develop a model State Emergency Telecommuting Plan.	Vetoed
AB 2966	Polanco	Requires the Office of Emergency Services to work with advocacy groups for the hearing impaired to provide accessibility to emergency services information for these individuals through the public media.	Chaptered 90-725
AB 2994	Eaves	Requires high occupancy buildings and facilities to have an emergency public address system.	Chaptered 90-1426
AB 3568	Areias	Requires the Office of Emergency Services to establish a Natural Disaster Volunteer Corps Program.	Chaptered 90-536
AB 3876	Brown, W.	Establishes a statewide task force on Emergency Broadcast Systems.	Vetoed
AB 3894	Filante	Increases the jail time of a person convicted of looting during a declared state of emergency.	Chaptered 90-1126
ABx 5	Eastin	Requires the Metropolitan Transportation Commission to develop an Emergency Transportation Management Plan.	Chaptered 90-28x
SB 48	Thompson	Requires railroads corporations to pay a fee to the Public Utilities Commission for the cost of regulating the accidental spills of railroad cars.	Chaptered 91-766
SB 480	Greene, L.	Defines the term "emergency shelter" for the purposes of the Emergency Housing and Assistance Fund. In addition, the bill makes conforming changes in the 1989 Budget Act.	Chaptered 89-1346
SB 506	Green, C.	Makes funds in the Emergency Investigation Account available to the Seismic Safety Commission without regard to fiscal year.	Chaptered 89-621
SB 721	Rosenthal	Requires the Public Utilities Commission to order cellular telephone companies to provide access to emergency telephone services without charge.	Chaptered 91-273
SB 921	Vuich	Requires the California Highway Patrol to manage hazardous substance spills or disasters on state highways.	Chaptered 89-265
SB 946	Maddy	Requires interest earned on emergency medical services funds to be deposited to that fund for disbursement.	Chaptered 91-1169

Category 3—Emergency Management and Response (continued)

Bill No.	Author	Description	Status
SB 2058	Kopp	Requires the Office of Emergency Services to develop a digital emergency broadcast system.	Vetoed, 1990
SB 2778	Russell	Requires local government disaster councils to update and submit a copy of their disaster plans to the Office of Emergency Services.	Chaptered 90-488
SBx 46	Lockyer	Provides an immunity from liability for architects, engineers and building inspectors who evaluate structures following a natural disaster.	Chaptered 90-30x
SJR 9	Campbell, W.	Requests the President and Congress of the United States to direct federal agencies to help coordinate a Urban Search and Heavy Rescue Plan.	Chaptered 89-R-63

Category 4—Disaster Recovery

Bill No.	Author	Description	Status
AB 65	Tanner	Extends the date funds may be expended from the Disaster Response Emergency Investigation Account to June 30, 1992.	Chaptered 91-0034
AB 541	Farr	Requires each state agency to develop a disaster recovery plan for the information and computer technologies used by the agency.	Chaptered 90-1380
AB 1663	Hauser	Amends various sections of the Natural Disaster Assistance Housing Program administered by the Department of Housing and Community Development.	Chaptered 90-19
AB 1825	Areias	Establishes the Natural Disaster Victims Foreclosure Assistance Program within the Department of Housing and Community Development.	Vetoed
AB 2627	Moore	Requires insurers to clearly disclose deductibles for residential earthquake insurance.	Chaptered 90-1167
AB 2652	Tanner	Appropriates funds to the El Monte Unified School District for the repair of the high school gymnasium damaged by the October 1, 1987 Whittier Narrows Earthquake.	Vetoed, 1990

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Category 4—Disaster Recovery (continued)

Bill No.	Author	Description	Status
AB 2811	Jones	Requires the Office of Statewide Health Planning and Development to submit a grant application to the the federal government on behalf of rural health care facilities.	Chaptered 90-755
AB 2837	Farr	Expands the authorization of the Natural Disaster Assistance Act to provide short-term loans.	Vetoed, 1990
AB 3263	Filante	Requires the Department of Housing and Community Development to develop and adopt emergency regulations for a Deferred Payment Rehabilitation Loan Program.	Chaptered 90-1509
AB 3291	Areias	Appropriates funds to the Natural Disaster Assistance Act to provide funds for the site preparation of temporary mobilehomes or manufactured housing.	Chaptered 90-1510
AB 3913	Areias	Creates a residential earthquake insurance program within the Department of Insurance.	Vetoed, 1990
AB 3637	Farr	Prohibits insurers from refusing a new policy of earthquake insurance.	Chaptered 90-1364
AB 4023	Cortese	Extends the 1986 Disaster Relief Program.	Chaptered 90-1197
ABx 16	Cortese	Requires the Office of Statewide Health Planning and Development to design a study identifying health care services which may be needed following a natural disaster.	Chaptered 90-34x
ABx 35	Cortese	Specifies that county offices of education, community college districts, and private nonprofit organizations are eligible for natural disaster assistance.	Chaptered 89-24x
ABx 36	Klehs	Appropriates \$20 million in disaster relief.	Chaptered 89-15x
ABx 38	Sher	Creates the Earthquake Permit Review Panel to approve or deny appeals from the Department of Transportation projects exempted from the Environmental Quality Act.	Chaptered 89-17x
ABx 39	Seastrand	Appropriates \$1,300,000 for the repair of state parks and historical resources damaged in the Loma Prieta earthquake.	Chaptered 89-8x
ABx 40	Farr	Requires the Department of Commerce to establish the California Earthquake Emergency Grant and Loan Program.	Chaptered 89-12x
ABx 41	Farr	Establishes the California Disaster Housing Rehabilitation Fund.	Chaptered 89-3x

Category 4—Disaster Recovery (continued)

Bill No.	Author	Description	Status
ABx 42	Vasconcellos	Amends the Natural Disaster Assistance Act to cover local government matching fund requirements for federal disaster relief programs.	Chaptered 89-1x
ABx 43	Vasconcellos	Allocates an additional \$20,000,000 to the Special Fund for Economic Uncertainties.	Chaptered 89-19x
ABx 44	Hauser	Establishes the Natural Disaster Emergency Shelter Program within the Department of Commerce.	Chaptered 89-5x
ABx 45	Brown, W	Establishes uniform procedures for filing a claim against the State as a result of the collapse of the San Francisco Bay Bridge and the I-880 Cypress structure.	Chaptered 89-22x
ABx 48	Areias	Establishes the 1/4 cent sales and use tax to finance disaster repairs and recovery associated with the Loma Prieta earthquake.	Chaptered 89-13x
ABx 53	Elder	Allows the State Teachers Retirement Fund and the Public Employees Retirement Fund to make low interest loans to members whose homes were damaged by the Loma Prieta earthquake.	Chaptered 90-35x
AJR 64	Filante	A resolution to memorialize the President and Congress of the United States to carefully study and consider a residential earthquake insurance program.	Chaptered 90-R-86
AB 2566	Eastin	Requires the Office of the State Architect to establish a working group of state officials to develop a computer tracking system for state plan checking.	Vetoed
SB 125	Hill	Requires claims for payment against the California Earthquake Recovery (insurance) Fund to be made within 90 days of the earthquake.	Chaptered 91-0104
SB 196	Killea	Allows for the short-term financing of seismic repairs to transportation projects.	Chaptered 90-1328
SB 289	Green, C.	Extends the implementation date of the California Earthquake Recovery Fund from July 1, 1991, to January 1, 1992.	Chaptered 91-0081
SB 339	Green, C.	Requires insurers to reduce their premium on earthquake insurance if the insured dwelling is in accordance with the retrofit standards established in this bill.	Chaptered 91-0664

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Category 4—Disaster Recovery (continued)

Bill No.	Author	Description	Status
SB 348	Robbins	Allows insurance companies to waive the coverage for living expenses on an earthquake insurance policy for non-owner-occupied dwellings.	Chaptered 91-0665
SB 412	Hill	Redefines the term "residential structures" to include multiple-unit structures for earthquake insurance Policy purposes.	Chaptered 91-0854
SB 439	Green, C	Allows the State Insurance Commissioner to establish a commercial earthquake insurance assistance program.	Vetoed, 1991
SB 480	Greene, L.	Defines the term "emergency shelter" for the purposes of the Emergency Housing and Assistance Fund. In addition, the bill makes conforming changes to the 1989 Budget Act.	Chaptered '89-1346
SB 505	Mello	Revises the state's matching fund requirements of the Natural Disaster Assistance Fund.	Vetoed, 1991
SB 640	Alquist	Transfers 1/4 cent Sales and Use Tax funds to the California Department of Transportation for the repair of highway bridges damaged in the Loma Prieta earthquake.	Chaptered 90-174
SB 995	Torres	Authorizes the Department of Housing and Community Development to use funds from the Emergency Housing Assistance Program to provide emergency shelters.	Chaptered 89-1329
SB 1631	Campbell, W.	Increases the grant limits of the Individual and Family Grants Program to \$10,000.	Chaptered 89-1123
SB 1742	Greene, L.	Requires the Department of Transportation to inspect all bridges for needed seismic safety repairs by December 1, 1991.	Chaptered 90-1082
SB 1852	Ayala	Requires the Seismic Safety Commission, in cooperation with the County of San Bernardino, to develop a model disaster recovery plan.	Vetoed, 1990
SB 1881	Alquist	Requires the Seismic Safety Commission to study the economic impact of a major urban earthquake in California.	Vetoed, 1990
SB 1942	Lockyer	Transfers funds from the Special Fund for Economic Uncertainties to the San Francisco Bay Bridge and I-880 Cypress Structure Disaster Fund.	Chaptered 90-1669

Category 4—Disaster Recovery (continued)

Bill No.	Author	Description	Status
SB 2132	Mello	Provides for loan guarantees to small businesses damaged as a result of the Loma Prieta Earthquake.	Chaptered 90-1525
SB 2183	Robbins	Prohibits insurers from refusing a new policy of earthquake insurance.	Chaptered 90-1526
SB 2199	Robbins	Specifies that an insurer cannot limit liability from a fire which was caused by an earthquake.	Chaptered 90-326
SB 2428	Mello	Allows community facilities districts to finance needed seismic repair or retrofit of their buildings and facilities damaged by the Loma Prieta earthquake.	Vetoed, 1990
SB 2596	Robbins	Provides that no policy of residential insurance can be offered unless the insured is offered a policy of earthquake insurance.	Chaptered 90-1166
SB 2608	Green, C.	Requires the Insurance Commissioner to appoint an advisory committee on earthquake insurance.	Chaptered 90-1169
SB 2833	Ayala	Allows funds from the 1/4 cent Sales and Use Tax funds for the Loma Prieta Earthquake to be made available to persons whose property suffered damage in the Upland Earthquake of 1990.	Vetoed, 1990
SB 2902	Hill	Creates the California Residential Earthquake (insurance) Recovery Program within the Department of Insurance.	Chaptered 90-1165
SBx 1	Mello	Allows local governments to be eligible for Federal Emergency Management Agency disaster relief programs.	Chaptered 89-2x
SBx 3	Marks	Establishes the California Disaster Housing Rehabilitation Fund.	Chaptered 89-4x
SBx 4	Greene, L.	Establishes the Rural Emergency Assistance Housing and Infrastructure Program within the Department of Housing and Community Development.	Chaptered 89-6x
SBx 10	Morgan	Appropriates funds for the repair of parks and historical resources.	Chaptered 89-7x
SBx 11	Mello	Appropriates \$19,400,000 to the Department of Social Services to augment costs associated with the Loma Prieta Earthquake.	Chaptered 89-9x
SBx 12	Mello	Establishes the California Earthquake Emergency Grants and Loan Guarantees Program.	Chaptered 89-11x

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Category 4—Disaster Recovery (continued)

Bill No.	Author	Description	Status
SBx 12	Mello	Establishes the California Earthquake Emergency Grants and Loan Guarantees Program.	Chaptered 89-11x
SBx 14	Morgan	Recalculates the amount of school funding available as a result of the Loma Prieta earthquake.	Chaptered 90-25x
SBx 30	Mello	Establishes a procedure for the transmittal of local sales tax following the Loma Prieta Earthquake	Chaptered 90-37x
SBx 38	Petris	Redefines the term "local agency" to include county offices of education as well as community colleges to provide them with eligibility for natural disaster relief funding.	Chaptered 89-23x
SBx 33	Mello	Establishes the 1/4 cent sales and use tax to finance disaster repairs and recovery associated with the Loma Prieta earthquake.	Chaptered 89-14x
SBx 34	Garamendi	Allows persons to carry over losses associated with the Loma Prieta earthquake to subsequent tax years on their personal income taxes.	Chaptered 89-16x
SBx 36	Kopp	Exempts state and local highway reconstruction projects resulting from the Loma Prieta earthquake from the Environmental Quality Act.	Chaptered 89-18x
SBx 39	Mello	Imposes a recalculation of the property tax increment between the local jurisdictions and the redevelopment agencies of Santa Cruz and Watsonville.	Chaptered 90-26x
SBx 40	Campbell, W.	Allocates an additional \$20,000,000 to the Special Fund for Economic Uncertainties.	Chaptered 89-20x
SBx 45	Lockyer	Provides funds for the San Francisco Bay Bridge and the I-880 Cypress Structure Disaster Fund.	Chaptered 89-21x
SBx 48	Mello	Appropriates \$2,553,000 in earthquake repair funds to the Department of Commerce.	Chaptered 90-32x
SBx 49	Dills	Provides eligibility for private nonprofit organizations for disaster assistance under the Federal Emergency Management Act.	Chaptered 90-33x

Category 4—Disaster Recovery (continued)

Bill No.	Author	Description	Status
SCA 1	Garamendi	Adjusts the annual calculation of the appropriations limit to the state budget due to a disaster.	Chaptered 89-R-66
SJR 57	Green, C.	Requests the President and Congress of the United States to establish a National Earthquake Insurance Program.	Chaptered 90-R-127
SR 39	Kopp	A resolution to request the Department of Transportation and the Metropolitan Transit District to develop criteria for extended Ferry Service in the Bay Area.	Resolution Adopted

Category 5—Research and Information/Education

Bill No.	Author	Description	Status
AB 209	Cortese	Appropriates \$481,000 to the Seismic Safety Commission from the Proposition 122 fund for the Commission's Proposition 122 Research Program.	Chaptered 91-0346
AB 429	Farr	Creates a Geographic and Land Information Systems task force to be convened by the Teale Data Center.	Chaptered 91-0782
AB 725	Hansen	Includes San Diego and Imperial Counties within the Southern California Earthquake Preparedness Project.	Chaptered 89-1056
AB 1873	Bentley	Requires all cities and counties to collect a building permit fee for the Strong Motion Instrumentation Program.	Chaptered 91-1096
AB 3551	Sher	Allows the California Department of Mines and Geology to borrow \$350,000 from the Strong Motion Instrumentation Program to implement an environmental impact reporting program for mining operations.	Chaptered 90-1097
AB 3897	Brown, W.	Requires the Department of Mines and Geology to establish a Seismic Hazards Mapping Program in California.	Chaptered 90-1168
ABx 15	Cortese	Appropriates \$140,000 to the Seismic Safety Commission to implement the first phase of the Proposition 122 Research Program.	Chaptered 90-31x
ACR 11	Katz	Establishes July as Earthquake Preparedness Month.	Chaptered 89-R-17

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Category 5—Research and Information/Education (continued)

Bill No.	Author	Description	Status
AJR 63	Speier	Memorializes the FCC to develop guidelines for closed captioning of commercial television to provide information to the deaf and hearing impaired during a disaster.	Chaptered 90-R-81
AJR 65	Polanco	Memorializes the President and the Congress of the United States to require the FCC to develop guidelines for closed captioning of information on commercial television during a disaster for the deaf and hearing impaired.	Chaptered 90-R-138
SB 1245	Alquist	Provides funding for the Earthquake Research Evaluation Conference to be held by the Seismic Safety Commission, and funds up to five grants to commercialize new earthquake technologies through the Department of Commerce.	Chaptered 91-0901
SB 1835	Alquist	Requires the Seismic Safety Commission to develop an earthquake research plan for California and to sponsor an earthquake research evaluation conference.	Chaptered 90-782
SB 1906	Lockyer	Requires the California Division of Mines and Geology to develop a prototype hazardous earthquake fault monitoring facility on the Hayward Fault.	Vetoed, 1990
SB 2035	Hart	Includes Santa Barbara County within the Southern California Earthquake Preparedness Project.	Chaptered 90-474
SB 2247	Garamendi	Establishes a research and development grant program to be administered by the California Council on Science and Technology.	Vetoed, 1990
SB 2518	Craven	Requires the Department of Housing and Community Development to make a seismic safety study of mobilehome foundation systems.	Chaptered 90-615
SB 2553	Green, C.	Requires the Seismic Safety Commission to develop and publish the "Earthquake Hazard Reduction Guide" to be mailed out to homeowners at the renewal of their homeowners insurance policy.	Vetoed, 1990

Category 5—Research and Information/Education (continued)

Bill No.	Author	Description	Status
SB 2792	Nielsen	Appropriates \$50,000 to California Division of Mines and Geology to perform a geologic hazard study of the Rogers Creek Fault.	Chaptered 90-1164
SR 53	Roberti	Encourages all Californians to participate in a duck, cover, and hold drill.	Chaptered _____ Resolution Adopted, 1990

Project: [Project Name]

Project Description: [Project Description]

Project Objectives: [Project Objectives]

Project Scope: [Project Scope]

Project Timeline: [Project Timeline]

Project Budget: [Project Budget]

Project Risks: [Project Risks]

Project Deliverables: [Project Deliverables]

Project Stakeholders: [Project Stakeholders]

Project Communication: [Project Communication]

Project Monitoring: [Project Monitoring]

Project Evaluation: [Project Evaluation]

Project Conclusion: [Project Conclusion]

Project Appendix: [Project Appendix]

Project References: [Project References]

Project Glossary: [Project Glossary]

Project Index: [Project Index]

Project Acknowledgments: [Project Acknowledgments]

Project Contact Information: [Project Contact Information]

Appendix A

Glossary

Appendix A

Glossary

Active fault. A fault that shows evidence of or is considered to be capable of movement within the last 10,000 years. The degree of movement is defined by the degree of displacement of the surface rocks.

Accretionary prism. An accretionary prism is a wedge-shaped mass of sedimentary rocks.

Anticline. A fold that is convex upward. It is a type of fold that is common in sedimentary rocks.

Basin. A large, roughly circular or oval-shaped depression in the Earth's crust. It is a type of fold that is common in sedimentary rocks.

Block. A large, roughly rectangular mass of rock that is bounded by normal faults. It is a type of fold that is common in sedimentary rocks.

ATC. Applied Technology Center.

Basin. A large, roughly circular or oval-shaped depression in the Earth's crust. It is a type of fold that is common in sedimentary rocks.

Block. A large, roughly rectangular mass of rock that is bounded by normal faults. It is a type of fold that is common in sedimentary rocks.

Continent. Continental. The large, roughly circular or oval-shaped depression in the Earth's crust. It is a type of fold that is common in sedimentary rocks.

Continental. Continental. The large, roughly circular or oval-shaped depression in the Earth's crust. It is a type of fold that is common in sedimentary rocks.

Extension. The ability of a material to be stretched. It is a type of fold that is common in sedimentary rocks.

Extensional. Extensional. The large, roughly circular or oval-shaped depression in the Earth's crust. It is a type of fold that is common in sedimentary rocks.

Extensional. Extensional. The large, roughly circular or oval-shaped depression in the Earth's crust. It is a type of fold that is common in sedimentary rocks.

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10/10/10

Appendix A

Glossary

Active fault. A fault that shows evidence of, or is suspected of having experienced surface displacement within the last 10,000 years. An active fault is considered to have the highest potential for future surface rupture.

Accelerograph. An instrument used to record very large earthquakes.

Aftershocks. Earthquakes that follow a main larger earthquake, most commonly smaller than the main shock.

Alluvium. Surficial sediments of poorly consolidated, gravels, sand, silts, and clays deposited by flowing water.

Amplification. As used herein, it refers to the near-surface amplifying (increase) of seismic waves.

ATC. Applied Technology Council.

Bedrock. Designates hard rock that is in its natural intact position and underlies soil or other unconsolidated surficial material.

Block Glide. A landslide where the slide mass remains essentially intact by moving outward and downward as a unit, most often along a pre-existing plane of weakness such as bedding, foliation, joints, faults, etc.

California Continental Borderland. The broad continental shelf area offshore of southern California which consists of several alternating ridges and trough-like basins that nearly parallel the shoreline.

Catastrophic Earthquake. A great earthquake, generally near Magnitude 8.0 or greater, capable of widespread tremendous damage in epicentral area accompanied by localized severe damage hundreds of miles from earthquake source.

Cohesion. The ability of soil particles to "stick" together. Term refers to relative strength of clay soils and term is used when discussing the "shear strength" of soils in general.

Collapsible Soils. Typically found in arid environments and associated with Holocene age or slightly older deposits on alluvial fans, collapsible soils undergo settlement when exposed to development practices such as construction and artificial irrigation.

Colluvium. A general term used by geologists to describe loose soil masses that have collected near the base of a steep cliff, slope or mountainside. Usually situated along the gently sloping margins of canyon bottoms.

Compaction. The compressing together of soil particles to increase the density of the soil. Usually used when describing construction practices that require that soils be compacted to 90% of a laboratory standard to provide soils that will support construction projects.

Conditionally Active Fault. A fault showing evidence of movement in the Quaternary but greater than 750,000 years ago (considered only for certain critical facilities).

Consolidated. Soil, or rocks, that have become very firm as a result of natural compaction.

Coseismic rupture. Ground rupture occurring during an earthquake.

Critical Facilities. There are several categories of critical facilities as follows:

- a) Any lifeline system facility under city jurisdiction whose operations are essential at times of emergencies, such as energy transmission systems, major utility lines, evacuation and disaster routes, and warehouses storing heavy rescue and debris clearing equipment;
- b) Essential facilities that are needed in times of emergency, such as medical facilities, fire and police stations, emergency operations centers, and communications centers;
- c) High-risk facilities that, if severely damaged, could cause catastrophic casualties or disasters far beyond the facility itself, such as nuclear power plants, dams and flood control infrastructure, freeway to freeway interchanges and bridges, and industrial plants that manufacture or store explosives, toxic materials, or petroleum products;
- d) High occupancy facilities having potential for catastrophic fatalities and crowd control problems such as high-rise buildings, large assembly public and private facilities and large multifamily residential complexes;
- e) Dependent care facilities that house populations with special evacuation considerations, such as educational facilities for preschool, public and private schools, rehabilitation centers, prisons, and major social care facilities, including group care homes and elderly care facilities and hospitals; and
- f) Economic facilities whose continued operation is paramount to avoiding severe economic impact, such as banking, vital record keeping, archiving complexes, airport and port facilities, and large industrial/commercial complexes.

Damping. The resistance to vibration that cause seismic waves to decay in their effects over time and distance through the earth.

Debris. Debris may be used to specify surficial material, soil, rock and vegetation that can be carried by a "debris flow".

Debris flow. A rapidly moving earth flow with a high water content, but carrying significant soil, rock and vegetation debris.

Deformation. A general term for the processes of folding, faulting shearing, compression, or extension of rock.

Differential Settlement. Nonuniform settlement; the uneven lowering of different parts of an engineering structure that often results in damage to the structure. Sometimes included with liquefaction as ground failure phenomenon.

Displacement. The relative movement of two sides of a fault, measured in any chosen direction; also the specific amount of such movement.

Dynamic Analysis. A complex earthquake-resistant engineering design technique (UBC - used for critical facilities) capable of modeling the entire frequency spectra, or composition, of ground motion. The method is used evaluate the stability of a site or structure by considering the motion from any seismic source.

Earthflow. Imperceptibly slow moving surficial material lubricated by water.

Earthquake. Vibratory motion propagating within the earth or along its surface caused by the abrupt release of strain from elastically deformed rock by displacement along a fault.

EERI. Earthquake Engineering Research Institute.

Engineering Geologist. A geologist who is certified by the state as qualified to apply geologic data, principles, and interpretation to naturally occurring earth materials so that geologic factors affecting planning, design, construction, and maintenance of civil engineering works are properly recognized and used. An engineering geologist is particularly needed to conduct investigations, often with geotechnical engineers, of sites with potential ground failure hazards, to investigate for subsurface groundwater effects, locate faults and date their last movements, and to recognize and develop an understanding of the geologic controls of landsliding and slope instability.

Epicenter. That point on the earth's surface which is directly above the point (focus) where an earthquake was generated in the earth.

Fault. A fracture (rupture) or split or a zone of fractures along which there has been displacement of adjacent earth material.

Fault Gouge. The clay material formed along the plane of a fault as a result of the crushing movement of the fault.

Fault line. The intersection of a fault surface with the surface of the earth or with any artificial surface of reference.

Fault Slip Rate. The average long-term movement of a fault as measured (in cm/year) and determined from mapped geologic information and applied to aiding in the determination of a fault's relative activity.

Fault System. The interconnecting of two or more sets of major faults.

Fault Zone. A fault zone is a specified width, or area, within which numerous faults may exist and be interconnected. Fault zones can be miles in width depending upon the character of the fault and the manner in which it has displaced and disrupted the local geology along its path.

Focus. The point within the earth which is the center of an earthquake and the origin of the earthquake waves (also called hypocenter).

Geotechnical Engineer. A licensed Civil Engineer who is also certified by the state as qualified for the investigation and engineering evaluation of earth materials and their interaction with civil engineering works. Usually evaluates the ability of the site soils to support the proposed engineering project, evaluates slope stability, and other physical characteristics of the soils in slopes and as interacting with foundation systems.

Ground Failure. Permanent ground displacement produced by fault rupture, differential settlement, liquefaction, or slope failure.

Ground Response. A general term referring to the response of the earth materials to the passage of earthquake vibrations. It may be expressed in terms such as maximum acceleration, dominant period, or as ground-motion spectra.

Ground Rupture. Typically referred to as the displacement of the earth's surface as a result of fault movement associated with an earthquake.

Intensity. A measure of the effects of an earthquake at a particular place and how the human observation of earthquake damages compares with the known magnitude (energy release) of the earthquake. In other words, how intense was the shaking phenomenon where a human witnessed the shaking.

Isoseismal Line. Lines drawn by seismologists and geologists to physically show on a map the limits within which certain levels of intensity of ground shaking were experienced during a large or major earthquake.

Lateral Force. The force of the horizontal side-to-side motion on the earth's surface as measured on a building during an earthquake.

Lateral Spread. Shallow angle slope failures cause by liquefaction of a subsurface layer; or typically, a low angle landslide type of movement on a gentle, but sloping terrain.

Lifeline System. Linear conduits or corridors for the delivery or services or movement of people and information (i. e. pipelines, telephones, freeways, roadways, railroads).

Liquefaction. Changing of a soil from a solid state to a temporary liquid state as a result of earthquake shaking combined with poor quality soils (typically fine grained sands and silts) and a shallow ground water table beneath. Can result to damage to structures, lifelines, as well as building foundation support.

Magnitude. A measure of the size of an earthquake based upon a determination of the energy actually released by the earthquake. Measurements are made by a seismograph and mathematical calculations are made to determine the magnitude (e. g. Richter, Moment).

Major Earthquake. Capable of widespread, heavy damage up to 50+ miles from the epicenter; generally near magnitude range of 6.5 to 7.0, or greater, but can be less depending upon rupture mechanism, depth of earthquake, and location relative to urbanized centers.

Maximum Probable Earthquake. Refers to the design earthquake used in probabilistic design analysis. The design earthquake is used to assess the maximum ground motion that can be expected within a certain period of time, for example, within a 30 year or 100 year period, depending upon the purpose, lifetime, or importance of a proposed engineering project. The more critical the facility, the longer the time period that will be considered for design.

Microseismic Data. Earthquake data that is usually instrumentally recorded, which humans cannot feel; usually Magnitude 3.0 or less.

Microzonation. The detailed mapping of various seismic hazards for use in urban and disaster planning.

Moderate Earthquake. Capable of causing considerable to severe damage, generally in the range of Magnitude 5.0 to 6.0 (Modified Mercalli Intensity < VI).

Mud Flow. Wet earth flowing downslope.

Nearfield Earthquake. Used to describe a local earthquake which is characterized by high frequency waveforms that are destructive to above-ground utilities and short period structures (less than about two to three stories in height).

Nonductile. Refers to concrete construction using columns and beams with insufficient steel reinforcing, making a structure brittle and prone to collapse during an earthquake.

Peak Acceleration. The greatest amplitude of earthquake acceleration measured. Often a mathematical value important to structural engineering earthquake design at a given site. May be horizontal or vertical.

Potentially Active Fault. A fault showing evidence of movement within the last 750,000 years but before 10,000 years ago and is capable of generating damaging earthquakes.

Psuedostatic. A simplified engineering analysis of the earthquake stability of a site or structure that translates earthquake motion into a static force to allow simplified mathematical calculations for design.

Reinforced Masonry. Masonry construction with steel reinforcement.

Resonance. Amplification of earthquake ground motion frequencies within bands matching the natural frequency of a structure and often causing partial or complete structural failure and collapse; effects may demonstrate minor damage to single-story residential structures while adjacent 3 or 4-story buildings may collapse because of matching frequencies.

Response Spectra. The range of potentially damaging frequencies of a given earthquake applied to a specific site and for a particular building or structure assuming different sizes of earthquakes at different distances.

Rock Fall. Situation where rock debris can fall vertically from a precipice, cliff or cutslope. A falling of debris that can occur rapidly without warning.

Rock Slide. Slippage of rock or soil down a slope. Typically involves more material than a rock fall.

Seiche. When a standing body of water (i.e. lake reservoir, swimming pool, lagoon) experiences waves generated by earthquake ground motion.

Seismic Risk. Given the location and magnitude of future earthquakes in a region, and a means for specifying the return period for each fault, the cumulative risk for a site to experience a certain level of ground shaking in a given period of time can be ascertained. Expressed as a probability for design and planning considerations, seismic risk factors depend on the type of development. ATC 3-06 (1978) recommends that a 10% chance of exceeding a design ground motion in 50 years (.002 percent probability of exceedance), which is equivalent to a 500 year return interval, be used for the design of critical structures such as lifelines, dams, and bridges. A 50 or 100-year return period, which is equivalent to a .01 percent probability of exceedance, is recommended for regional planning purposes or noncritical structures.

Shear Strength. The mathematical physical strength of soil or rock that determines the material's ability to resist failure. A value derived from "shear testing" of soil samples to derive a mathematical value that can be utilized in geotechnical engineering analysis of slopes and for foundation design.

Slip Rate. A geological designation for the amount of displacement experienced by a fault that can be used to compare the relative activity of the fault.

Soft-Story Construction. A structure that has a least one story, often the ground level, with significantly less rigidity or strength than other floors in the structure during seismic loading, e. g. apartment dwellings with garages on the lower floor, etc.

SSC. Seismic Safety Commission.

Standard Cone Penetrometer. An engineering borehole measuring device that is able to translate soil penetration resistance values into a measure of how soils might react to liquefaction potential or possible settlement.

Strike-Slip Fault. A fault with a vertical to subvertical fault surface in three dimensions that displays evidence of horizontal and opposite displacement.

Structural Engineer. A licensed Civil Engineer certified by the State as qualified to design and supervise the construction of engineered structures.

Subsidence. A local or regional mass movement that involves principally the gradual downward settling or sinking of the solid earth's surface with little or no horizontal motion.

Tectonic. Of or pertaining to the forces involved in, or the resulting structures or features, of the upper part of the earth's crust.

Tsunami. Inundation of low-lying coastal areas from long period surface gravity waves caused by sudden, large-scale seafloor displacements, either as a result of fault displacement, or secondary seabed failures such as slumps and landslides, or it may be originated from some distant earthquake.

Unconsolidated Material. A sediment that is loosely arranged (or compacted) whose particles are not cemented together and which occur at, or near, the surface of the ground.

Water Table. The level beneath the ground surface where the groundwater remains at an equal elevation. A perched water table occurs above an impermeable bed of soil or rock underlain by unsaturated soil or rock of sufficient permeability to allow movement of groundwater.

Appendix B

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Seismic and Geological Technical Appendix to the Safety Element of the City of Coachella General Plan Update 2020

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Figure 10
Figure 11

Seismic and Geologic Technical Appendix to the Safety Element of the City of Coachella General Plan Update 2020

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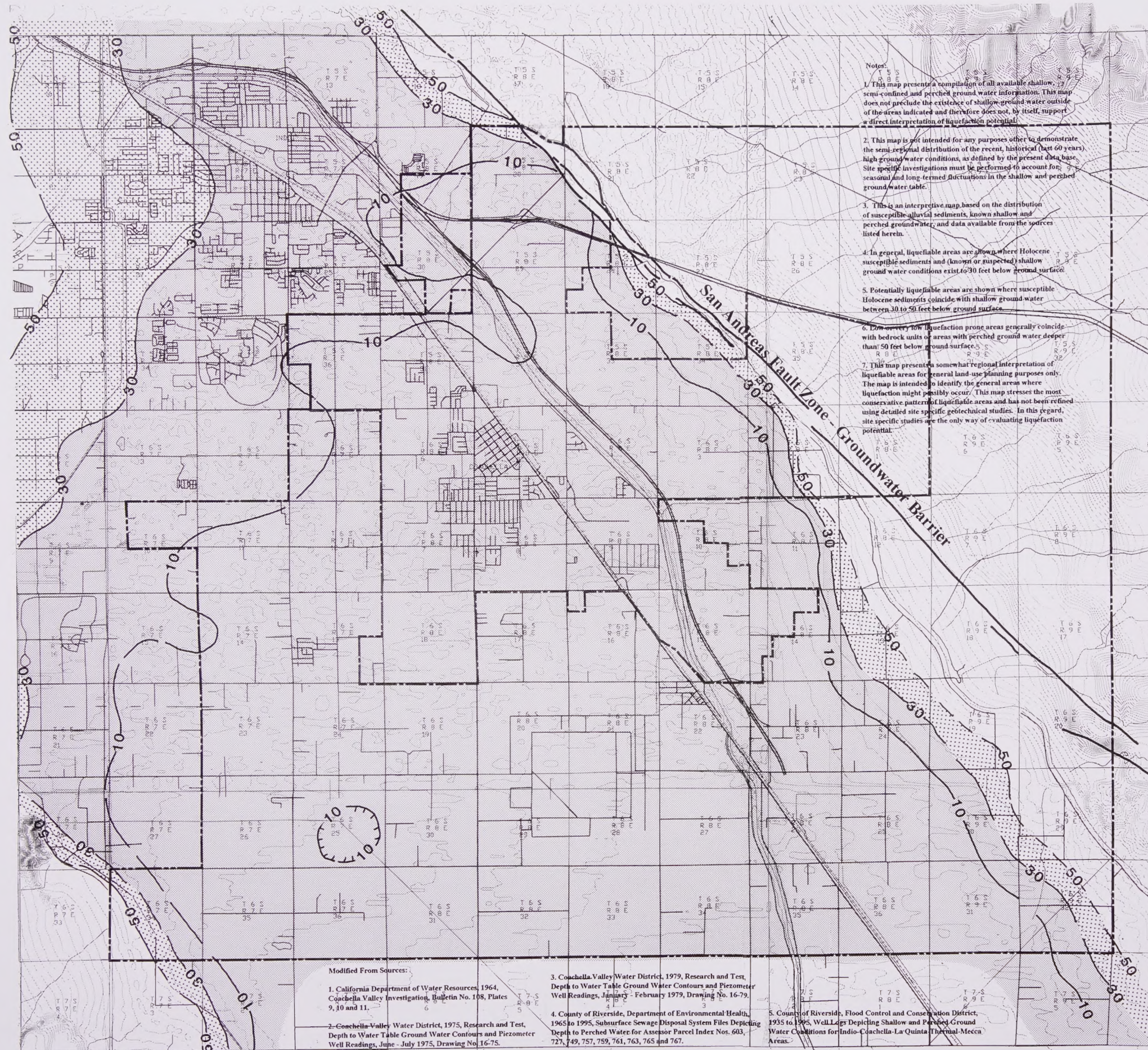
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Aerial Photos Reviewed

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Explanation Shallow and Perched Ground Water

10~ Depth to Ground Water -
Shallow Well Determined

50~ Depth to Ground Water -
Approximately Located

Explanation Generalized Liquefaction Potential

Liquefiable Area

Potentially Liquefiable Areas

Low to Very Low Liquefaction Potential

Coachella General Plan Area

Figure 47

Shallow and Perched Ground Water
and Generalized Liquefaction Potential

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FEET

Steven C. Suitt and Associates
Consulting Engineering, Mining and Environmental Geologists,
Hydrogeologists and Earth Science Professionals

30020 Windward Drive, Canyon Lake, CA 92587

C. Existing and Potential Mineral Resources Report

**City of Coachella
General Plan Update 2020
Existing and Potential
Mineral Resources**

Prepared For:

**City of Coachella
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**July 1996
5CL124**

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City of Coachella General Plan Update 2020 Existing and Potential Mineral Resources

1.0 MINERAL RESOURCES

Summary. Existing or potential mineral resources in the Coachella General Plan Area include sand and gravel, clay, oil and gas, and geothermal. Portions of the Mecca Hills and associated southwest trending tributaries or canyons contain sedimentary or alluvial deposits composed of sand and gravel construction aggregate resources used for making concrete, asphalt, road base and subbase materials, masonry and golf course sand, and other concrete products. Clay is present as "brick-red" fault gouge within the San Andreas fault zone portion of the Mecca Hills. Also associated with the presence of the San Andreas fault zone and general vicinity is a moderate potential for low-temperature (less than 90° C) geothermal resources, and a low potential for oil and gas resources.

The California Department of Conservation, Division of Mines and Geology (CDMG) has estimated that the quantity of construction aggregate resources that occur in the Palm Springs Production-Consumption area as 3.2 billion tons, of which only 67 million tons were available as reserves as of 1988. Based on CDMG consumption forecasts, the available reserves in this Production-Consumption area would be depleted by the year 2012, unless additional resources are converted to reserves or alternative resources are utilized. Approximately 61 million tons or about 2% of the total sand and gravel resources in the Palm Springs Production-Consumption area were identified by the CDMG in 1988 to occur in the General Plan Area. Clay resources, in excess of five million tons, have been identified along the San Andreas fault zone within the Mecca Hills. Clay mines south of the General Plan Area have utilized this clay to seal irrigation canals or ditches. Oil and gas leases covered a high percentage of the Mecca Hills and vicinity as recently as 1983. According to the U. S. Geological Survey (USGS) and Bureau of Mines (BOM), the area southwest of the San Andreas fault has a low potential for oil and gas resources. Additionally, the USGS indicates that the General Plan Area is situated within the Salton Trough region that has "significant lateral extent favorable for discovery and development of local sources of low-temperature geothermal water".

State law requires cities to designate such mineral deposits on their General Plan, and to avoid developing incompatible uses on or near them. Mining and processing aggregates or other minerals creates noise, dust and heavy truck traffic that is presently and potentially harmful to existing and proposed nearby residential areas. However, impacts from construction of surface developments overlying these sand and gravel or other existing or potential mineral deposits, or land-use restrictions that would prohibit their development would constitute a loss of valuable mineral resources which generally cannot be mitigated. A summary Planning Area checklist that presents the relative degree of concern for loss of mineral resources or impacts from mineral development is depicted in Table 1.

1.1 Mineral Resource Mining History, Background and State Designations

Documented historical exploration and mining of clay, sand and gravel, geothermal, and oil and gas resources has occurred in the Coachella General Plan Area or vicinity since the early 1920's (Morton, et. al., 1988). Some of these deposits (sand and gravel) are consid-

City of Coachella Mineral Resources Evaluation - Table 1
Summary Checklist of Mineral Resource Environmental Concerns *

CATEGORY	POTENTIAL HAZARD/CONCERN	NONE TO SLIGHT	Relative Degree of Concern			COMMENTS
			LOW	MODERATE	HIGH	
Loss of Mineral Resources	* Loss of Access * Deposits Covered by Changed Land-Use Conditions * Zoning Restrictions		*	*	*	Minimal roads

* Compared to other areas of southern California, as modified from California Division of Mines and Geology Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports.

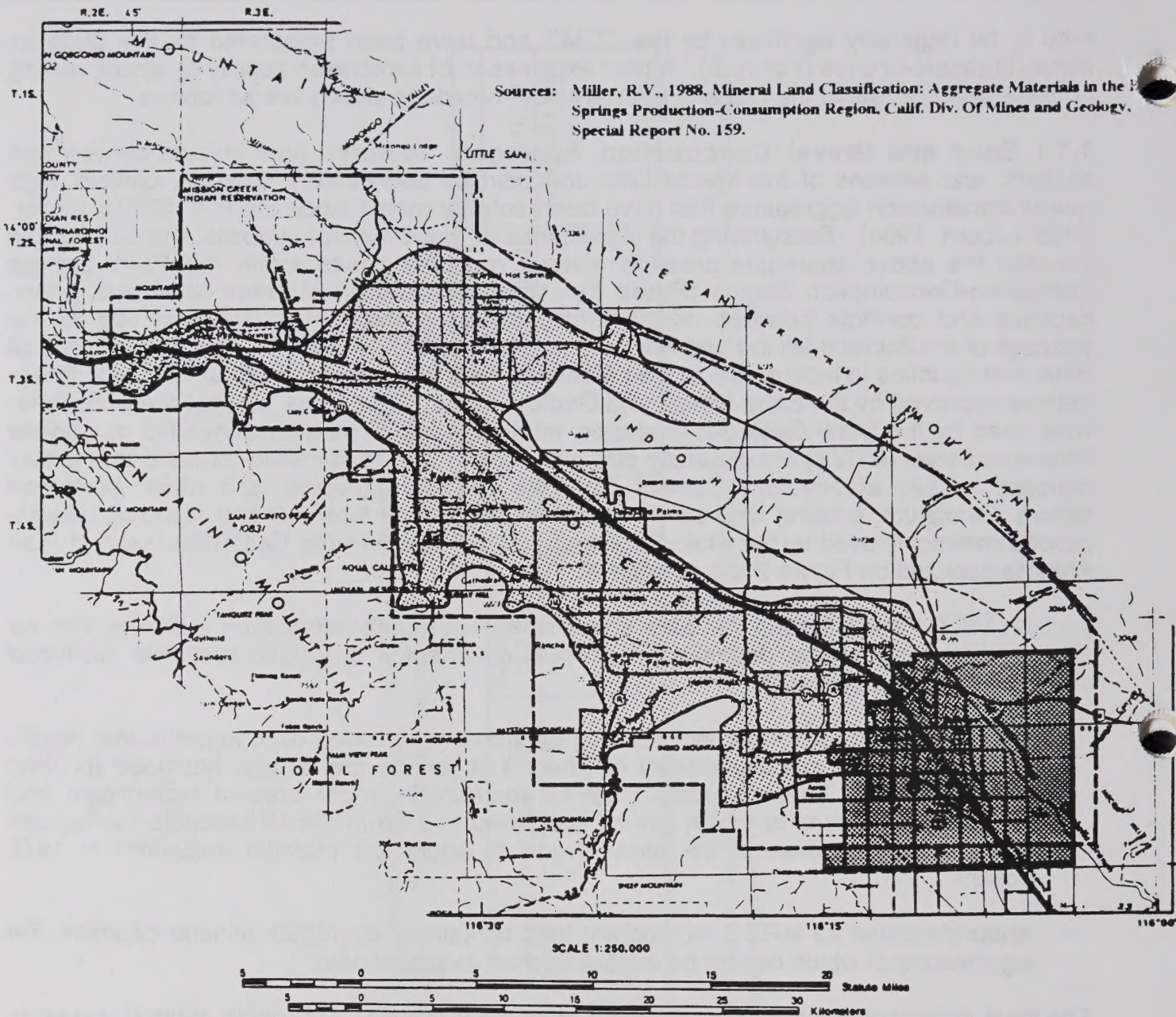
ered to be regionally significant by the CDMG and have been designated by the State as mineral resource zones (Figure 2). A brief explanation of exploration activity or actual mining of these deposits within the General Plan Area or immediate vicinity are as follows.

1.1.1 Sand and Gravel Construction Aggregate History. An unnamed canyon with alluvium and portions of the Mecca Hills underlain by sedimentary deposits, contain high quality construction aggregates that have been actively mined since the mid 1970's (Miller, 1988; Lilburn, 1994). Recognizing the significance of these mineral deposits, the CDMG has included the above aggregate areas in mineral resource zones within the Palm Springs Production-Consumption Region (Figure 1). Urban preemption of prime sand and gravel deposits and conflicts between mining and other uses throughout California led to the passage of the Surface Mining and Reclamation Act of 1975 (SMARA). This Act requires all cities and counties to incorporate in their General Plans the mapped mineral resource designations approved by the State Mining and Geology Board. There are at least three designations used by the State Geologist to classify mineral lands. These designations or Mineral Resource Zones (MRZ's) are generally classified based on the suitability of sand and gravel deposits for use as Portland Cement Concrete (PCC) aggregate, and other geological factors. By statute, existing land use is not considered. The three mineral resource classifications commonly used by the State Geologist that are found in the Coachella General Plan Area as depicted on Figure 2 are as follows:

- An MRZ-1 classification includes areas where adequate information indicates that no significant aggregate deposits are present or where it is judged that little likelihood exists for their presence.
- Areas classified as MRZ-2 indicate that adequate information exist to prove that significant mineral deposits are present or where it is judged that a high likelihood for their presence exists. These deposits must be marketable under present technologic and economic conditions or which can be estimated to exist in the foreseeable future, and that contain in excess of \$5 million worth of aggregate material measured in 1978 dollars.
- Areas classified as MRZ-3 incorporate land containing aggregate mineral deposits, the significance of which cannot be evaluated from available data.

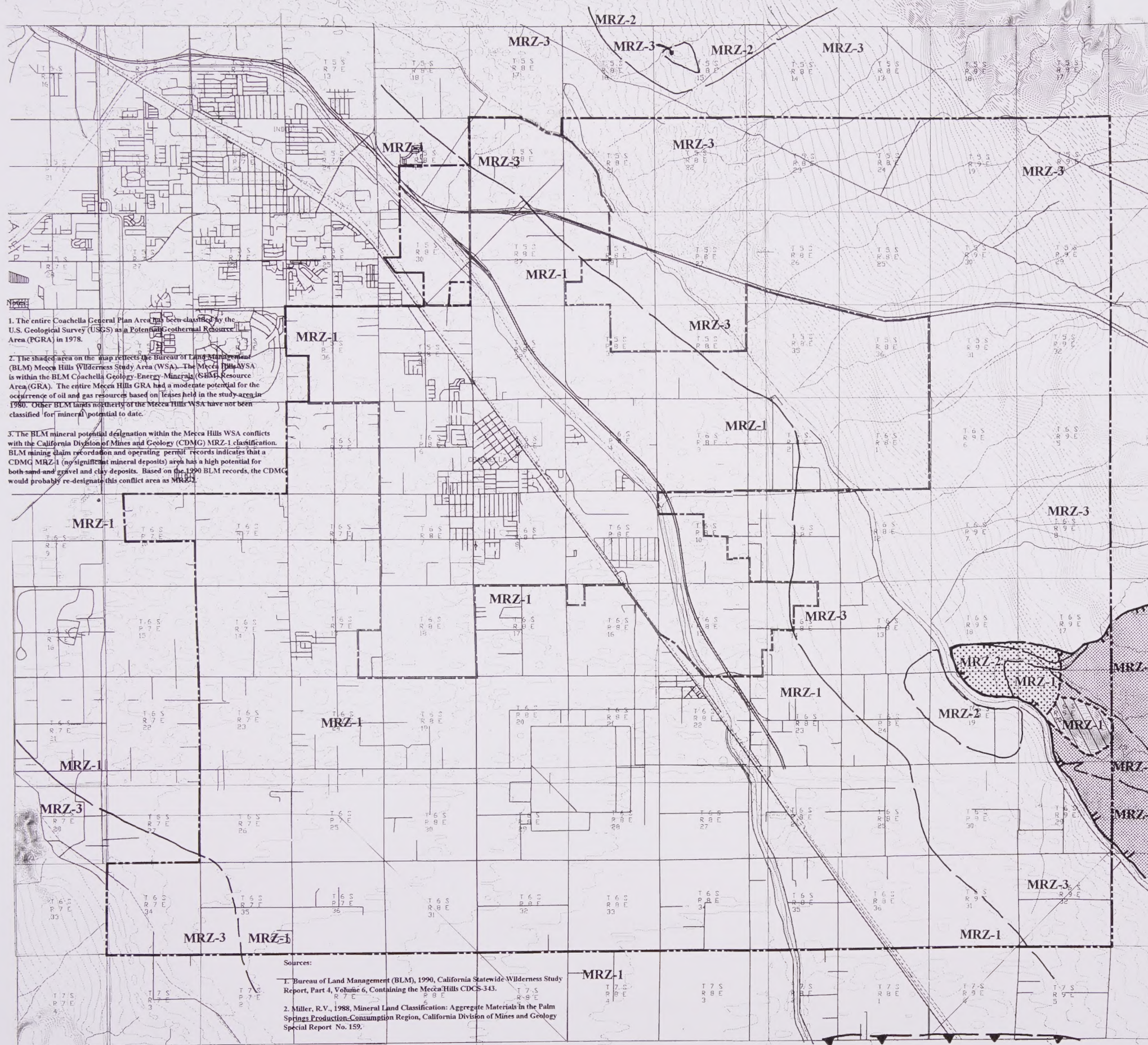
The most important classification is MRZ-2 because it signifies a valuable mineral resource. To further evaluate MRZ-2 areas, the CDMG has subdivided the MRZ-2 classification into sector designations. This assists with defining the quantities of available high quality mineral resources. Sectorization is important because it provides a semi-quantifiable estimate of construction aggregate resources which are likely to be available to satisfy societies needs for the next 50± years. Additionally, areas within MRZ-2 classifications are sectorized if they have current land uses which are similar to those areas that have had feasible mineral extraction in the past. According to the CDMG (Miller, 1988), MRZ and sector designations have not been amended since 1987.

Those portions of the Coachella General Plan Area that have been classified as a MRZ-2 with resource sector designations are shown on Figure 3. These sectors, located primarily in the southeasterly portion of the Coachella General Plan Area (Sector H-1 through H-3), indicate the existence of mineral deposits that meets certain criteria for value and marketability as defined by the CDMG and SMARA. The City of Coachella is required by SMARA to adopt policies recognizing the importance of all CDMG identified mineral resources (MRZ-2), clar-



Explanation

-  Palm Springs Production-Consumption Region
-  Areas Identified by OPR to be Urbanized or Potentially Urbanized by 1990
-  Coachella General Plan Area



1. The entire Coachella General Plan Area has been classified by the U.S. Geological Survey (USGS) as a Potential Geothermal Resource Area (PGRA) in 1978.

2. The shaded area on the map reflects the Bureau of Land Management (BLM) Mecca Hills Wilderness Study Area (WSA). The Mecca Hills WSA is within the BLM Coachella Geology-Energy-Minerals (GEM) Resource Area (GRA). The entire Mecca Hills GRA had a moderate potential for the occurrence of oil and gas resources based on leases held in the study area in 1980. Other BLM lands north of the Mecca Hills WSA have not been classified for mineral potential to date.

3. The BLM mineral potential designation within the Mecca Hills WSA conflicts with the California Division of Mines and Geology (CDMG) MRZ-1 classification. BLM mining claim recordation and operating permit records indicates that a CDMG MRZ-1 (no significant mineral deposits) area has a high potential for both sand and gravel and clay deposits. Based on the 1990 BLM records, the CDMG would probably re-designate this conflict area as MRZ-2.

Sources:

1. Bureau of Land Management (BLM), 1990, California Statewide Wilderness Study Report, Part 4, Volume 6, Containing the Mecca Hills CDCS-343.

2. Miller, R.V., 1988, Mineral Land Classification: Aggregate Materials in the Palm Springs Production-Consumption Region, California Division of Mines and Geology Special Report No. 159.



CDMG Mineral Land Classification Palm Springs Production-Consumption Region Aggregate Resources

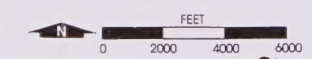
- Explanation**
- MRZ-1** Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence.
- MRZ-2** Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood for their presence exists.
- MRZ-3** Areas containing mineral deposits the significance of which cannot be evaluated from available data.
- Mineral Resource Zone (MRZ) Contact

- BLM Mineral Resource Potential**
- Explanation**
- High potential for the occurrence of Sand and Gravel deposits.
 - High potential for the occurrence of Clay deposits.
 - Moderate potential for the occurrence of Geothermal Resources.
- Boundary of Mecca Hills Desert Conservation Area - 343.
- Northern boundary of Known or Inferred Geothermal Resources (Thermal Waters for Direct heat or Aquaculture)

Coachella General Plan Area

Figure 2

CDMG Mineral Land Classification and BLM Mineral Resource Potential Map



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